THE Journal

MARCH

1958

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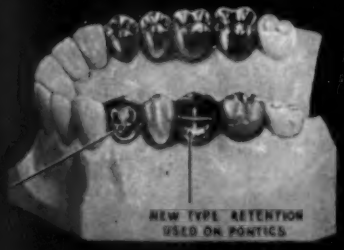

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TOUGH—

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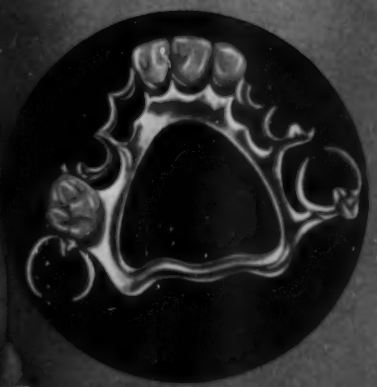

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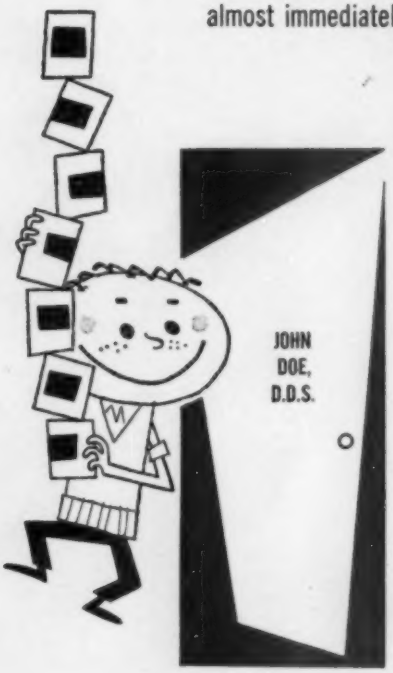

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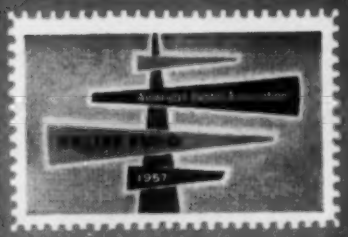

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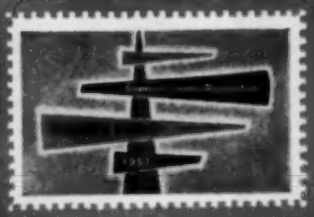

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⅓ comes from animal food products (all dairy foods including butter, meat, poultry, fish and eggs) which supply: ¾ of our calcium; ⅔ of our riboflavin; about ⅔ of our protein; ½ of our niacin; ⅓ of our iron and thiamine; and ¼ of our vitamin A, chiefly preformed . . .

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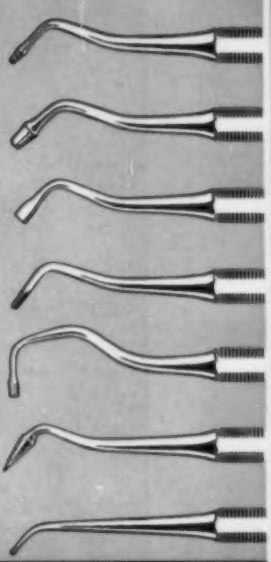

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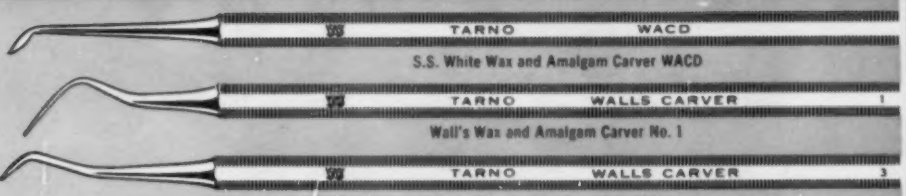

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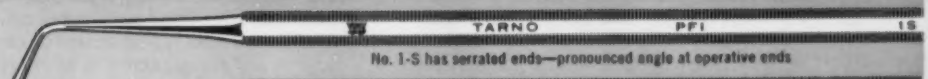
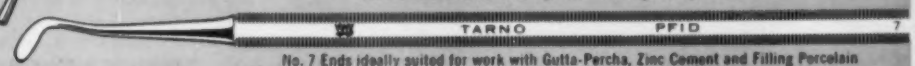


No. 1-S has serrated ends—pronounced angle at operative ends



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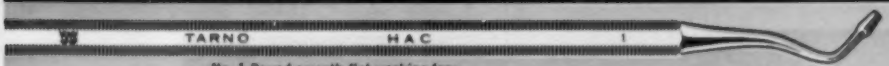
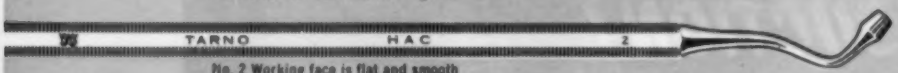
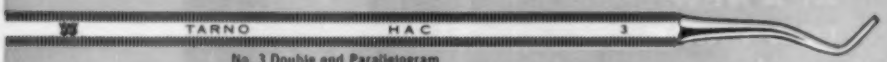


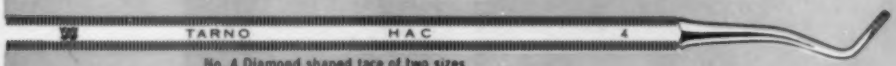
No. 1 Round smooth flat working face



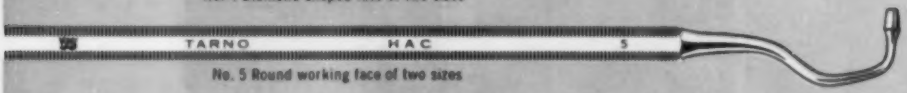
No. 2 Working face is flat and smooth



No. 3 Double end Parallelogram

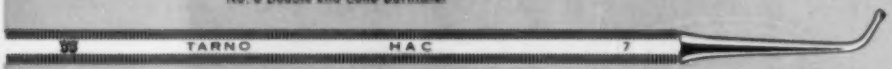


No. 4 Diamond shaped face of two sizes

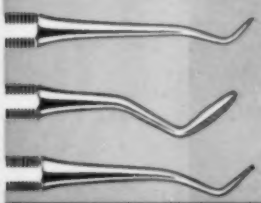


No. 5 Round working face of two sizes

No. 6 Double end Cone Burnisher



No. 7 Double end Ball Burnisher



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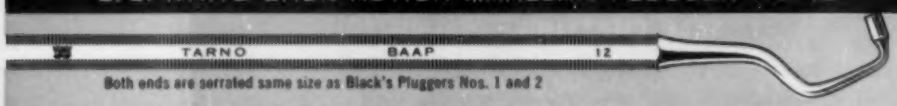
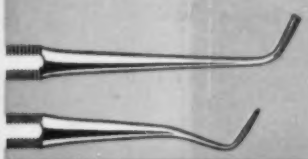


Both ends are serrated same size as Black's Pluggers Nos. 1 and 2



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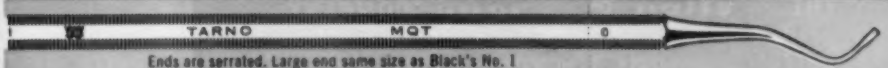

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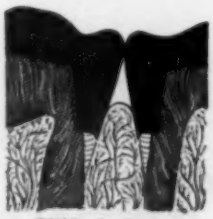
DWG. A: Contact too far to gingival



DWG. B: Contact too close to occlusal

DWG. C: Contact normal

The importance of contact areas

The drawings shown here are mesio-distal sections through portions of two biscuspids, and illustrate contact areas and form of interproximal spaces.

In drawing A the contact is too far to the gingival. This creates a wedge-shaped occlusal embrasure, into which food is packed. The force created destroys the alignment of the teeth, damaging the gingival tissues.

Drawing B shows a contact too close to the occlusal. Such a contact does not provide the sluice-way effect so necessary for tissue stimulation and for self-cleansing action.

Drawing C represents the ideal point of contact forming the correct interproximal space.

(Above prepared under the direction of George T. Cowger D.D.S.)

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A-1 inlays
B-2 bridges
B-3 partials

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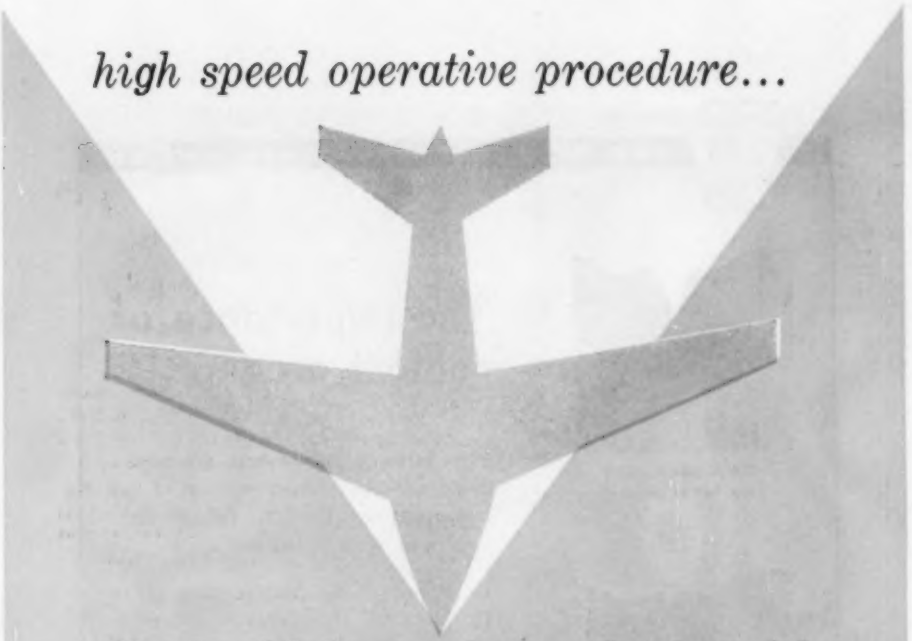

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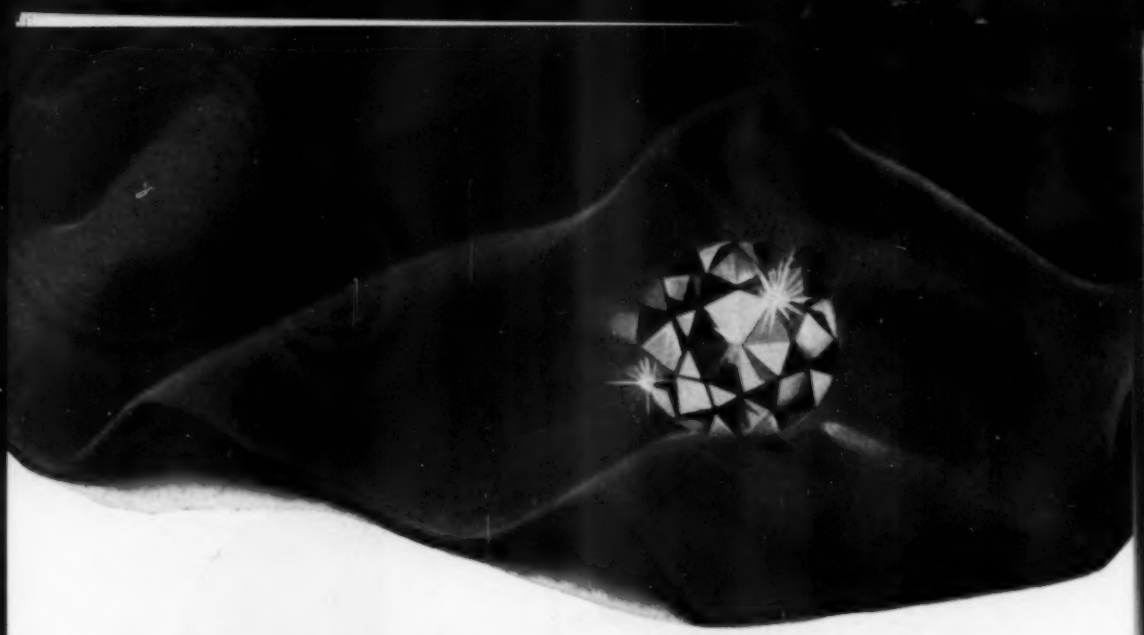

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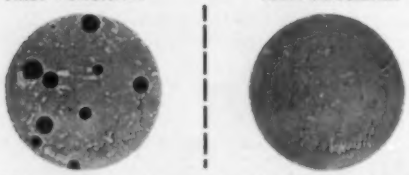

Note in these two photomicrographs how the denser, more homogeneous structure of vacuum fired porcelain is substantially free from the voids and bubbles found in conventional porcelain.

trubyte Bioform® teeth

The VACUUM FIRED PORCELAIN Teeth

THE DENTISTS' SUPPLY COMPANY OF N.Y.

YORK, PENNSYLVANIA

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Reaction of the human dental pulp to cavity preparation
I. Effect of water spray at 20,000 rpm

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The current trend in restorative dentistry is to employ higher and higher rotary speeds to remove hard tooth structure more efficiently. It has been demonstrated, both under experimental and clinical conditions, that an increased efficiency in cutting tooth structure can be attained readily by the use of tungsten carbide burs or diamond stones at high speeds. Although present day dental equipment is capable of producing speeds in excess of 150,000 rpm, the majority of preparations made today are cut in the range of 15,000 to 25,000 rpm.

Studies done in the past of procedures carried out at lower speeds have emphasized the pulpal response to filling materials with little regard to injuries resulting from cavity preparation. Kramer and McLean[1] pointed out that the histological findings changed over a period of time after the insertion of fillings in experimental teeth. Besides the changes taking place in the pulpal tissue immediately after cavity preparation and filling, a continuing stimulus from the filling material tended to influence the response to the initial stimulus. In a later study[2] in which thermocouples were used, Peyton and Henry reported that heat generated in grinding teeth may reach a level of more than 60°F. above the ambient temperature and attributed temporary damage to the pulp and possible loss of vitality to such thermal changes. On the other hand, Lisanti and Zander[3] reported that ther-

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1. Kramer, I., and McLean, J. Response of the human pulp to self-polymerizing acrylic resterations. Brit. D. J. 92:255 May 20; 92:281 June 3, 1952.

2. Peyton, F., and Henry, E. The effects of high speed burs, diamond instruments and air abrasive in cutting tooth tissue. J.A.D.A. 49:426 Oct. 1954.

3. Lisanti, V., and Zander, H. Thermal injury to normal dog teeth; in vivo measurements of pulp temperature increases and their effect on the pulp tissue. J. D. Res. 31:548 Aug. 1952.

mally injured pulps of dogs healed after temperature elevations in the range of 125° to 600°F.

A review of the literature indicates that little or no consideration has been given to the biological response of pulpal tissue to high speed instrumentation. The present study was designed to evaluate the effect of a coolant on the pulpal reaction of human teeth cut with a diamond stone at 20,000 rpm.

MATERIALS AND METHODS

The patients selected for study had noncarious, noninfected, vital teeth that had to be extracted for periodontal and prosthetic reasons. Sixty teeth were treated and removed from 9 patients whose ages ranged from 27 to 57 years (average 42.4). Three intact teeth without cavity preparations were extracted to provide "normal" material for comparison. However, the pulpal tissue of untreated teeth proved to be less suitable for comparative study than were the uninvolved regions of the pulp adjacent to and opposite the regions underlying the cavity preparations in treated teeth.

Typical Class V cavity preparations were cut in the gingival region of the facial surfaces of all teeth with an inverted cone no. 37 diamond stone at 20,000 rpm. The depth and outline form were similar for each morphological type of tooth as dictated by clinical experience. The handpiece speed was checked with a tachometer before and after each group of preparations was made. In an attempt to standardize the operative procedure, one operator performed all the clinical work and the same dental unit and handpiece was used.

Intermittent pressure was used on 27 teeth that were cut without spray. The preparation was flushed with water several times during the procedure. Thirty-three teeth were prepared with a continuous air-water spray and uniform pressure. All preparations were air dried and filled with zinc oxide and eugenol of the same batch.

After cavity preparation, the teeth were removed under local anesthesia at intervals from one hour to 36 days (see table). Extraction was done by surgical excision (buccal flap), with careful application of the forceps to the root. Immediately after extraction, the zinc oxide filling was removed to facilitate fixation of the pulp in 10 per cent Formalin.

After decalcification in 5 per cent formic acid, the teeth were washed, dehydrated, and embedded in paraffin. Multiple sections, 6 microns thick, were cut and stained with hematoxylin and eosin. The PAS stain was used in certain instances. Sections were considered acceptable for study when dentinal tubules could be followed from the cavity floor to the pulp chamber. This insured proper orientation of the pulp with respect to the cavity preparation and permitted an accurate measurement of the thickness of the dentin between the cavity floor and the pulpal surface.

HISTOLOGICAL FINDINGS IN TIME SEQUENCE

The histological findings and other pertinent data are summarized in the table. The criteria used in the comparisons are defined as follows:

Superficial tissues include the odontoblastic layer, zone of Weil and cell-rich zone. All other tissues located toward the center of the pulp are considered the "deeper" tissues.

R.D. (thickness of remaining dentin): A stage micrometer was used at magnification of X100 and an approximate measurement was made of the narrowest width of dentin between the floor of the cavity preparation and the pulp chamber.

Extent of pulpal damage: Lesions were coded as mild (M) if the cell-rich zone (Fig. 6) beneath the zone of Weil was relatively intact. Lesions were coded as severe (S) when the cell-rich zone was

missing and not according to the number of infiltrating inflammatory cells, as other investigators have described.

Displaced odontoblasts: The amount of displacement was coded according to an arbitrary scale, indicating the relative number of odontoblasts located in dentinal tubules. The degree of displacement was recorded as shallow (S) when odontoblasts were confined to the predentin region; as deep (D) when found deep in the tubules of calcified dentin, in some instances reaching almost to the floor of the cavity preparation.

Lesions in one-hour specimens, when present, were very slight and similar in both the "with-spray" and "nonspray" categories. Edematous changes were noted consistently, and the odontoblastic layer was either raised from the predentin or the odontoblasts were separated from each other. Occasionally, minute focal hemorrhages and shallow displacement of odontoblasts were observed, but infiltrating inflammatory cells were not present.

By 24 hours, all the "with-spray" lesions revealed disorganization of the odontoblastic layer with displacement of most of the odontoblasts into the dentinal tubules. Those remaining behind were surrounded by neutrophilic granulocytes. The deeper tissues exhibited hyperemic capillaries, focal hemorrhages, and infiltrating neutrophils. The lesions were confined to the region beneath the cut dentinal tubules (Fig. 1). The cell-rich zone, though heavily infiltrated with neutrophils, was generally intact. The "nonspray" specimens exhibited relatively bloodless lesions characterized by cellular degeneration, loss of cellular detail, and edema. All the missing odontoblasts could not be explained on the basis of displacement. These pulpal lesions extended beyond the limits of the cut dentinal tubules and involved more of the coronal pulp or even the opposite pulpal surface (Fig. 2).

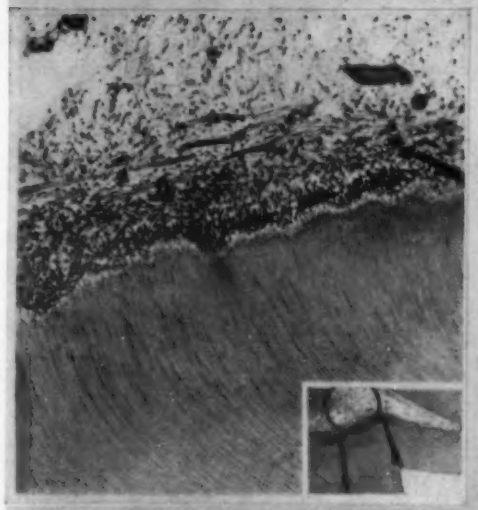
In the 2 to 4 day period, a network of long, narrow, capillaries had appeared in the superficial layers of the "with-spray" specimens and in the mild lesions of the "nonspray" specimens (Fig. 3). However, the severe lesions of the "nonspray" category were similar to those of the one-day specimens, except that a few infiltrating neutrophils were present (Fig. 4).

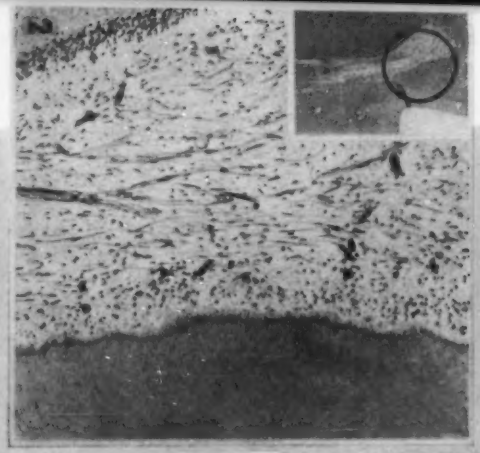
By six days the mild lesions in both categories presented similar pictures. Granules of hemosiderin had become very prominent in all foci of hemorrhage. Proliferation of fibroblasts in the cell-rich zone was conspicuous (See Figure 5). Lymphocytes and monocytes had increased in number, and neutrophils had decreased. One "nonspray" specimen with a severe lesion had developed an abscess.

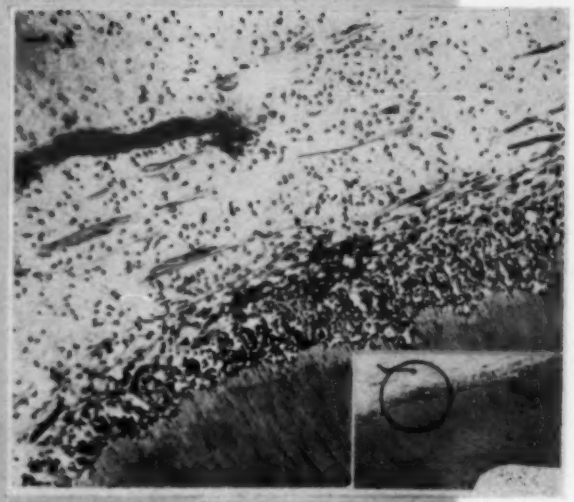
By 10 to 11 days the severe lesions showed connective tissue replacement of the former odontoblastic layer. Large dilated capillaries were found in the deeper tissues (Fig. 7). Neutrophils still persisted in the "nonspray" lesions. One "nonspray" specimen apparently undergoing expansion of the original lesion showed massive necrosis of almost all of the pulp above the lower margin of the preparation (Fig. 8).

At 20 days the first formation of irregular dentin was seen in a "with-spray" specimen. Differentiating mesenchymal cells, some multinucleated, appeared to be orienting themselves toward and into the odontoblastic layer which was being reconstructed (Fig. 9). In one "nonspray" specimen, the entire pulp exhibited an acute inflammatory response. The odontoblastic layer on the opposite surface from that in which the cavity was prepared was partially disrupted and demonstrated concomitant "displacement" of some cells (Fig. 10).

By 35 to 36 days small amounts of irregular dentin were seen in two "with-spray" specimens, and larger quantities were present in five "nonspray" specimens (Fig. 11). Despite the ability of







the pulp in one "nonspray" tooth to form irregular dentin under part of the cavity preparation, abscess formation had occurred in the region over which the remaining dentin was the thinnest (Fig. 12). Two specimens in each category presented lesions consisting of immature granulation tissue (Fig. 13). In the vicinity of some regions of irregular dentin formation, PAS positive material was found near the new odontoblasts or cells beginning to function as such. Many cells were entrapped like osteocytes within the new irregular dentin (Fig. 14). In some odontoblastic layers undergoing reconstruction there were clusters of cells which appeared more like fibroblasts than odontoblasts (Fig. 15). "Displaced" odontoblasts had diminished in number in each category.

DISCUSSION

A comparison of the "with-spray" specimens with the "nonspray" specimens revealed a more acute and prolonged pulpal response in the "nonspray" specimens. In the "nonspray" category, three specimens showed abscess formation and several others had expanding lesions with the potential for developing abscesses. Apparently when a coolant is used, the floor of the cavity preparation can be extended much closer to the pulp tissue without inducing abscess formation, since abscesses were not present in any of the "with-spray" pulps. In "with-spray" specimens, extension of the preparation to within 0.3 mm. of the pulp did not

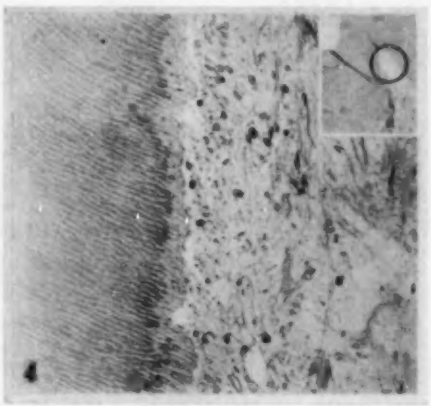


Fig. 1 • One-day "with-spray" specimen (no. 11). Note prominence of hyperemic capillaries, exudation, hemorrhage, neutrophils infiltrating the odontoblastic layer, and deep displacement of odontoblasts into the dentinal tubules. (R.D. 1.2 mm.; X141; insert, X16)

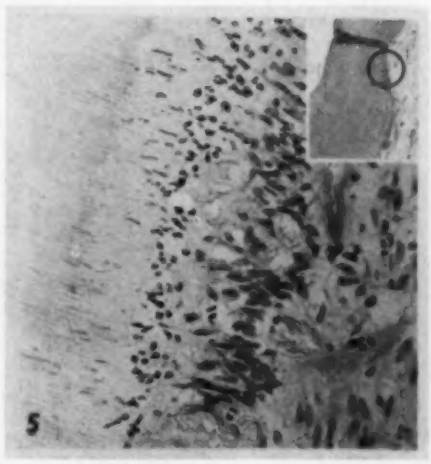


Fig. 2 • One-day "nonspray" specimen (no. 17). Loss of odontoblastic layer, particularly above cut tubules, is demonstrated in insert. Enlargement shows loss of cellular detail and lack of an inflammatory infiltrate. (R.D. 0.6 mm.; X105; insert, X16)

Fig. 3 • Two-day "with-spray" specimen (no. 18). Long, narrow capillaries, apparently previously formed but nonfunctioning, have been activated by the inflammatory response. (R.D. 0.8 mm.; X105; insert, X10)

Fig. 4 • Two-day "nonspray" specimen (no. 20). Note lack of capillaries and paucity of inflammatory cells. Cellular degeneration and edema are prominent. (R.D. 1.1 mm.; X275; insert, X10)

Fig. 5 • Six-day "with-spray" specimen (no. 28). Fibroblastic proliferation is seen in the cell-rich zone with orientation of nuclei toward the odontoblastic layer. (R.D. 1.0 mm.; X348; insert, X12)

Table • Histological findings and other pertinent data

Clinical data				Histopathologic findings										
				General observations				Superficial tissue (odontoblastic, Weil and cell-rich zones)					Deeper tissues	
Specimen number	Tooth	Age and sex	Preparation time in seconds with (+) and without (−) a coolant	Approximate thickness of remaining dentin (R.D.) mm.	Extent of pulpal damage: mild (M) severe (S)	Lesion confined to cut tubules	New irregular dentin (D); granulation tissue (G); abscess formation (A)	Amount of displacement −, +, ++, +++	Shallow (S) or deep (D) displacement	Type and number of inflammatory cells; neutrophils (N), lymphocytes (L), monocytes (M), and eosinophils (E); 1, 2, 3	Increased number of capillaries −, +, ++, +++	Hemorrhage −, +, ++, +++	Degree of inflammatory response −, +, ++, +++	Type of inflammatory cells in decreasing order: N, L, M, E
One hour specimens														
1	3|	50-F	37+	1.3	>M	Yes	−	−	−	−	−	−	−	−
2	|2	57-M	23+	0.7	−	−	−	−	−	−	−	−	−	−
3	|1	57-M	20+	0.4	>M	Yes	−	+	S	−	−	−	−	−
4	|7	46-M	21+	2.2	−	−	−	−	−	−	−	−	−	−
5	|8	46-M	19+	1.4	M	Yes	−	−	−	−	−	+	−	−
6	|3	50-M	75−	0.9	M	Yes	−	>+	S	−	+	+	−	−
7	|1	57-M	57−	0.5	M	Yes	−	−	−	−	+	−	−	−
8	|6	46-M	51−	0.9	M	Yes	−	>+	S	−	+	+	−	−
24 hour specimens														
9	|1	32-M	40+	0.9	M	Yes	−	−	−	N-2	+	−	++	L, M
10	|5	27-F	50+	0.5	M	Yes	−	+++	D	N-3	+	++	+++	N, L, M
11	|4	27-F	35+	1.2	M	Yes	−	+++	D	N-3	−	−	+++	N
12	|3	27-F	25+	1.2	M	Yes	−	+++	D	N-3	−	−	++	N
13	|1	27-F	15+	0.3	M	Yes	−	+	D	N-1	+	−	+	N
14	|3	32-M	40+	0.9	M	Yes	−	+++	D	N-3	−	−	+++	N, L, M
15	|4	32-M	90−	0.6	S	No	−	++	D	N-2	+	−	+	N, L, M
16	|4	27-F	70−	0.9	S	No	−	+	D	N-1	−	−	−	−
17	|5	27-F	50−	0.6	S	No	−	+	D	N-1	−	−	+	N, L, M
48 to 96 hour specimens														
18 (2)*	4|	27-F	25+	0.8	M	Yes	−	+++	D	N-3	++	−	++	N, L, M
19 (2½)	3|	46-M	30+	1.4	M	Yes	−	−	−	−	++	−	−	−
20 (2)	5|	27-F	80−	1.1	S	No	−	++	D	−	−	−	+	N, M
21 (2½)	1|	46-M	39−	1.2	S	Yes	−	++	D	N-2	−	++	+++	N
22 (4)	|3	33-F	30+	1.7	M	Yes	−	+	S	−	++	−	−	−
23 (4)	2|	27-F	50+	1.3	M	Yes	−	−	−	−	+	−	−	−
24 (4)	|3	33-F	81−	1.5	S	Yes	−	+	D	N-1	++	−	+	N, M, L
25 (4)	3|	27-F	75−	1.2	S	No	−	++	D	N-2, M-1	+	+	+	N, M, L

6 day specimens														
26	1	47-M	40+	1.4	M	Yes	–	++	D	I-1, M-1	+++	+++	++	M, I, N
27	2	47-M	35+	1.0	M	Yes	–	+	D	I-1, M-1	++	+	++	I, M
28	4	47-M	30+	1.0	M	Yes	–	++	S	N-3	+++	++	+	N, I
29	7	55-M	40–	2.0	S	Yes	–	+++	D	I-2	+++	+++	++	N, M
30	5	55-M	60–	1.8	M	Yes	–	+	S	–	+	+	–	–
31	1	47-M	52–	1.6	M	Yes	–	++	D	I-1	+++	++	++	I, M
32	3	47-M	55–	0.7	S	No	A	+++	D	N-3	+	+	++	N, I
10 to 11 day specimens														
33	3	27-F	25+	2.0	M	Yes	–	–	–	–	+	–	–	–
34	8	27-F	30+	1.4	M	Yes	–	–	–	–	+++	+++	+	I, M
35 (11)	3	27-F	40+	1.1	M	Yes	–	–	–	–	+	–	–	–
36	1	35-M	25+	0.7	S	Yes	–	+	D	I-3, M-3, E-3	+++	+	+	I, M
37	4	27-F	55–	1.5	S	Yes	–	+++	D	N-3, I-2, M-2	+++	++	++	I, M
38	1	35-M	35–	0.3	S	No	A	+	D	N-3	–	+++	+++	N
20 day specimens														
39	5	35-M	32+	0.8	M	Yes	D	+	S	–	+++	+++	–	–
40	2	35-M	17+	1.1	M	Yes	–	+	D	–	++	–	+	I, M
41	5	35-M	42–	0.7	M	Yes	–	+	S	I-1, M-1	+++	+++	++	I, M
42	4	35-M	48–	0.4	M	Yes	–	+	S	I-1, M-1	++	–	+	I, M
43	3	35-M	47–	0.8	S	No	–	++	D	N-2, I-1, M-1	+++	–	+	I, M
44	2	35-M	46–	0.4	S	No	–	+++	D	N-3, I-1, M-1	+++	+++	+++	N, I, M
35 to 36 day specimens														
45 (35)	3	35-M	25+	0.4	M	Yes	D	–	–	I-1, M-1	++	–	+	I, M
46 (35)	4	35-M	25+	0.6	S	Yes	G	>+	S	I-2, M-2, E-1	++	++	+++	I, M, E
47 (35)	3	35-M	26+	1.4	M	Yes	–	>+	S	–	++	–	–	–
48	8	46-M	26+	1.2	M	Yes	D	>+	S	I-1	++	+++	–	–
49	5	46-M	30+	0.5	S	Yes	G	++	D	N-3	+++	++	++	I, N, M, E
50	1	46-M	31+	0.8	M	Yes	–	>+	S	–	++	–	+	I, M
51	2	46-M	24+	0.8	M	Yes	–	++	S	–	+++	++	–	–
52	3	46-M	29+	0.9	M	Yes	–	–	–	–	+	–	–	–
53	8	46-M	22+	2.0	M	Yes	–	–	–	–	++	–	–	–
54	5	46-M	28–	2.0	M	Yes	–	–	–	–	++	++	–	–
55	4	46-M	29–	0.7	S	No	D, G	++	D	N-2, I-1, M-1	+++	+++	++	N, I, M, E
56	2	46-M	32–	0.7	S	No	D	++	S	N-1, I-1	++	–	++	I, M
57	1	46-M	43–	0.9	S	No	D	–	–	–	++	+	+	I, M
58	3	46-M	46–	1.5	M	Yes	D, G, A	>+	S	–	++	–	+	I, M
59	4	46-M	47–	0.2	S	No	D	+	S	N-3	++	+	+++	N, I, M
60	7	46-M	48–	1.5	M	Yes	–	>+	S	–	+++	++	–	–

*Days

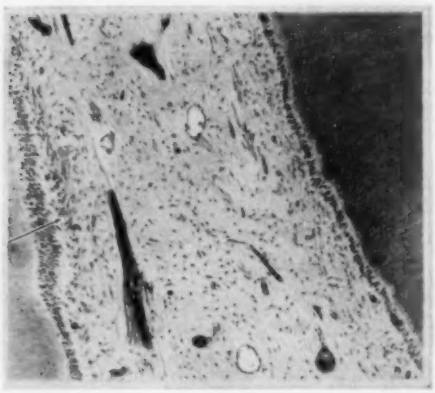


Fig. 6 • Six-day "with-spray" specimen (no. 26). Arrow shows typical control area, cell-rich zone separated from the odontoblastic layer by zone of Weil. (R.D. 1.4 mm.; X105)

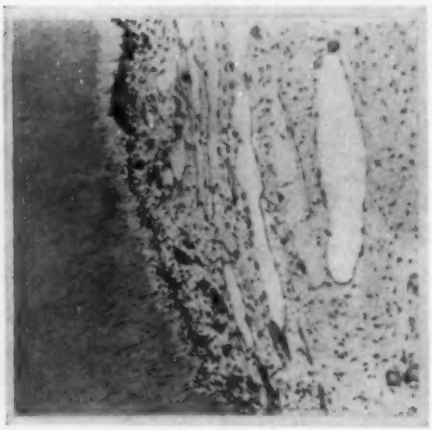


Fig. 7 • Ten-day "nonspray" specimen (no. 37). Dilated vascular channels are prominent. (R.D. 1.5 mm.; X105)

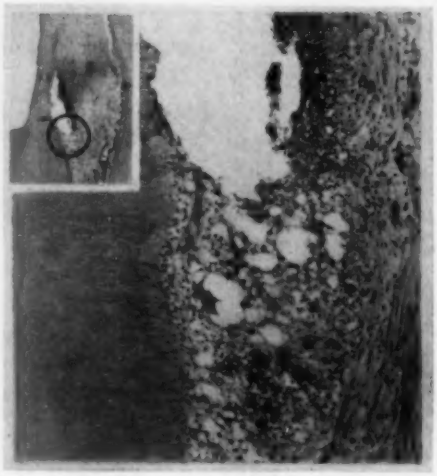


Fig. 8 • Ten-day "nonspray" specimen (no. 38). Insert demonstrates abscess cavity and loss of cellular detail in necrotic pulp. Enlargement shows active expansion of apical border of lesion. (R.D. 0.3 mm.; X105; insert, X10)

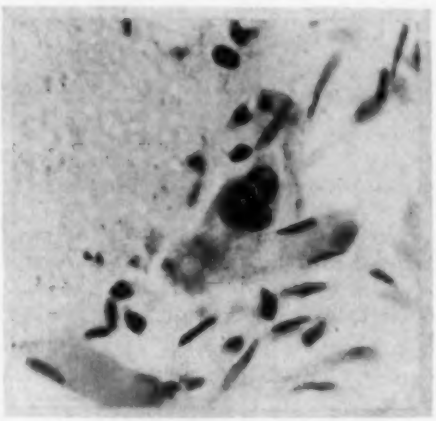


Fig. 9 • Twenty-day "nonspray" specimen (no. 42). A multinucleated giant cell is located adjacent to the predentin. (R.D. 0.4 mm.; X385)

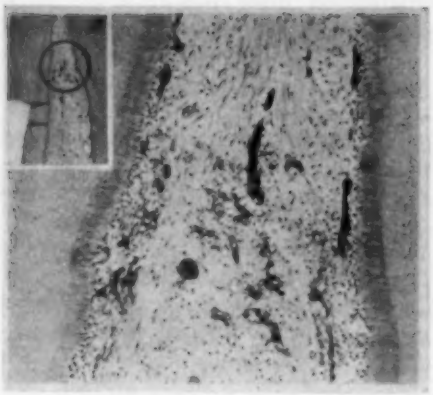


Fig. 10 • Twenty-day "nonspray" specimen (no. 44). Inflammatory response is uniform on both sides of pulp as is number of displaced odontoblasts. The insert permits region of pulp associated with cavity preparation to be identified. (R.D. 0.4 mm.: X105; insert, X10)

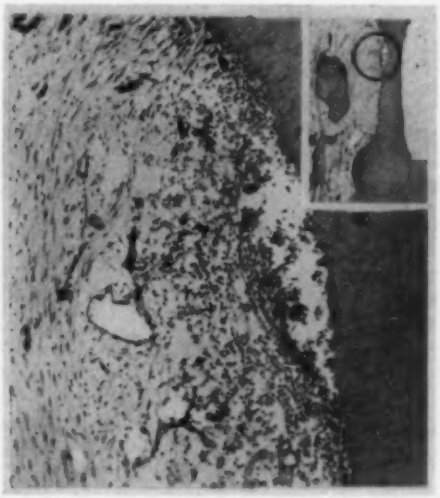


Fig. 12 • Thirty-six-day "nonspray" specimen (no. 59). Note concentration of neutrophils and early walling-off of abscess. (R.D. 0.2 mm.: X117; insert, X10)

Fig. 11 • Thirty-six-day "nonspray" specimen (no. 55). Bulbous mass of irregular dentin is typical of specimens in "nonspray" category. (R.D. 0.7 mm.: X23)

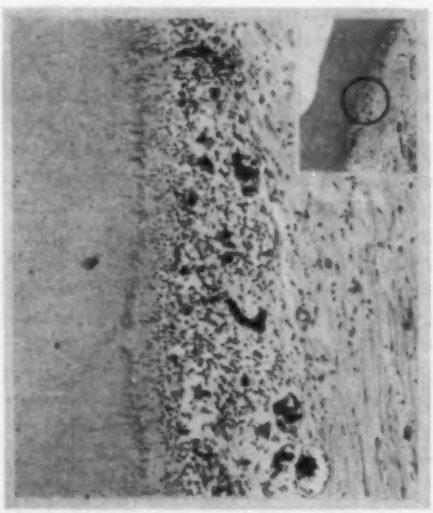


Fig. 13 • Thirty-six-day "with-spray" specimen (no. 49). Immature granulation tissue with many neutrophils and dilated, hyperemic capillaries has formed. Compare these capillaries in size with those in Figure 3. (R.D. 0.5 mm.: X105; insert, X20)

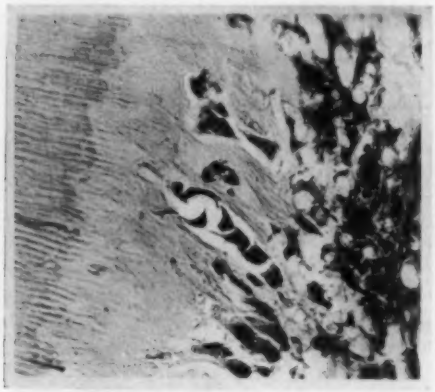


Fig. 14 • Thirty-six-day "nonspray" specimen (no. 55). Lack of definite tubular structure gives newly secreted material a relatively homogeneous texture. Note entrapped cells. (R.D. 0.7 mm.; X335)

result in abscess formation, but "nonspray" specimens with less than 0.6 mm. of remaining dentin demonstrated abscesses. The greater quantity of irregular dentin formation in the "nonspray" specimens also suggested a reaction to more severe pulpal damage.

Kramer and McLean,[1] Fasoli,[4] Van Huysen and Gurley,[5] Manley,[6] James and Diefenbach,[7] Shroff,[8] and Maeglin[9] have called attention to the important factor of cavity depth by noting that the closer the floor of the cavity preparation is to the pulp, the greater is the inflammatory response. Further study of this factor of depth by Van Huysen and Gurley[5] suggested that although there was correlation between the thickness of the remaining dentin and the degree of pulpal reaction, there was no relation between cavity depth and the type of pulpal response.

It appeared that when only the odontoblastic layer was destroyed, regeneration began at the level of the cell-rich zone. Proliferating mesenchymal tissue quickly apeared in the damaged region and began to reconstruct the superficial layers (6 to 10 days). This phenomenon resembled primary repair. If the cell-rich zone had been destroyed, however, regeneration was initiated from deeper tissues. The defect created was too wide for primary repair and filling in with granulation tissue was required, as in secondary repair. A longer period than that of this experiment is evidently required for complete resolution of the latter type of lesions.

A hyperemic response was a consistent observation in almost all of the specimens extracted after 48 hours. The boundaries of the lesions coincided approximately with those of the cut tubules in all the "with-spray" specimens. Fifteen of the "nonspray" specimens exhibited lesions extending beyond the cut tubules.

The average preparation time with spray was shorter than the average time without spray (table). The rapid removal of debris and the lubricating action of the water accounts for the difference. Nevertheless, many other factors preclude relating the cavity preparation time to the severity of pulpal response.

"Displaced" odontoblasts were equally plentiful in both categories; however, only in the "nonspray" specimens were they found beyond the cut tubules and in the dentin of the opposite (lingual) surface. Shallow displacement of odontoblasts was limited to the predentin and was found in the one-hour specimens and in the mild lesions of later periods. Relatively few displaced odontoblasts were

4. Fasoli, G. Silikatzemente und Pulpaveränderungen. Ztschr. Stomatol. 22:225 April 1924.

5. Van Huysen, G., and Gurley, W. Histologic changes in the teeth of dogs following preparation of cavities of various depths and their exposure to oral fluids. J.A.D.A. 26:87 Jan. 1939.

6. Manley, E. Investigations into the early effects of various filling materials on the human pulp. D. Record 62:1 Jan. 1942.

7. James V., and Diefenbach, G. Prevention of histopathologic changes in young dogs' teeth by the use of zinc oxide and eugenol. J.A.D.A. 29:583 April 1942.

8. Shroff, F. Effects of filling materials on the dental pulp; an histological experimental study with special reference to synthetic porcelain. New Zealand D. J. 42:99 July; 42:145 Oct. 1946.

9. Maeglin, B. Kunstharzfüllungen und Pulpa. Schweiz. Mschr. Zahnhk. 62:712 July 1952.

observed by the end of the study period, especially in specimens showing irregular dentin formation. Possibly the elongated nuclei commonly seen deep in the tubules of earlier specimens degenerated and disappeared after 35 to 36 days.

In recent years the phenomenon described in the literature as "aspirated" odontoblasts has received considerable attention. Orban[10] was the first to describe the condition in which odontoblasts were found within dentinal tubules underlying cementum which had been crushed by the surgical forceps. Subsequently, Maeglin[9] and Kramer and McLean[1] observed odontoblasts in tubules underlying cavity preparations filled with self-curing resins. Although Kramer and McLean associated "aspiration" with self-curing acrylic restorations, they occasionally observed this phenomenon in teeth filled with other materials. On the other hand, no aspiration was noted in control teeth in which zinc oxide and eugenol was employed either as a filling or as a liner. It should be pointed out, however, that these control teeth were not extracted until 21 to 28 days after filling.

Odontoblastic "displacement" resulting from the use of the forceps is very characteristic. When the root is compressed, the odontoblasts apparently move in mass into the predentin layer, or a little beyond, leaving behind a clearly denuded zone. Compression displacement from the forceps was found in our specimens but only in the region of the root. In teeth extracted after 24 hours, displacement due to operative procedures was accompanied by an infiltrate of inflammatory cells among the remaining odontoblasts. The displacement of odontoblasts was not uniform, as nuclei could be observed at various levels throughout the tubules, in some instances extending almost to the floor of the cavity preparation.

It appears that displacement of the odontoblast goes through several phases. At first only part of the nucleus moves into the tubule leaving a bulbous end protruding into the odontoblastic layer. This gives a carpet tack appearance (Fig. 16). Later the entire nucleus is found in predentin. Finally, the nucleus may travel any distance into the dentinal tubule proper.

Fig. 15 • Thirty-six-day "nonspray" specimen (no. 56). Clusters of proliferating cells are scattered irregularly among hyperemic capillaries. (R.D. 0.7 mm.; X360; insert, X10)

The fact that displacement appeared in the dentin opposite the cavity preparation and regions adjacent to expanding inflammatory lesions underlying the cut tubules suggests that this phenomenon is the result of crowding of the pulpal tissues in a confined region by the edema, hyperemia, and inflammatory exudation. The intensity of the displacement was proportional to the degree of the inflammatory response. Since the phenomenon was not elicited during actual cavity preparation, but followed it, since it coincided with the development of the inflammatory response, and since the odontoblasts were apparently pushed outward into the tubules by an internal

10. Orban, B. Odontoblasts in the dentinal tubules. J. D. Res. 20:553 Dec. 1941.

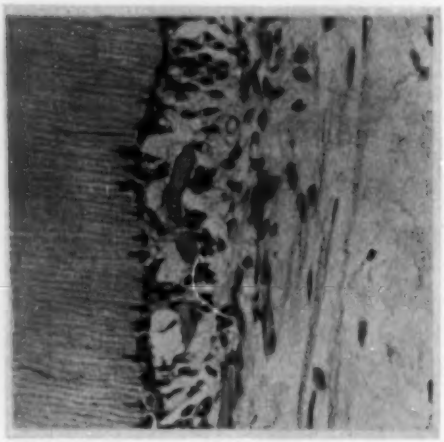


Fig. 16 • Four-day "with-spray" specimen (no. 22). Carpet tack formations at ends of dentinal tubules are numerous. (R.D. 1.7 mm.; X205)

force rather than an outside suction, the term "displaced" seems to be more appropriate than "aspirated."

The persistence of hyperemic and dilated capillaries, especially those severely ectatic, near formations of irregular dentin, has also been noted by Manley,[11] Fish,[12] and others. According to current ideas regarding bone fracture healing, these vascular characteristics are believed to represent physiologic rather than pathologic changes. Johnson[13] states that the capillaries adjacent to a bone fracture dilate to permit an increased flow of blood into the injured region and fill its capillary bed. The resultant increase in tissue fluid around this hyperemic capillary bed, coupled with protein breakdown products from aseptic inflammation, stimulates cell proliferation and callus formation. This set of circumstances may help to explain a similar posttraumatic phenomenon in the pulp.

The present work bears out the observation of other investigators that it is difficult to develop a precise and complete pathological picture on the basis of such factors as cavity depth, thickness of remaining dentin, and time interval after the operation because of the variable histologic responses of different teeth in different individuals. Nevertheless, some characteristics common to lesions in specific categories could be detected and have therefore been described.

It is of considerable importance to recognize that extensive pulpal reactions can be caused solely by cutting or grinding of hard tooth structure. Before the additional insults of filling materials in themselves can be evaluated, an accurate base line for each operative technic must be established in order to determine the range of lesions induced. The possibilities of recovery from these lesions should also be investigated.

SUMMARY AND CONCLUSIONS

1. An evaluation was made of the effect of a coolant on the pulpal response of 60 sound human teeth in which cervical (Class V) preparations were made with an inverted cone diamond stone rotating at 20,000 rpm. Thirty-three teeth were cut with spray and 27 preparations were made without spray. The teeth were filled with zinc oxide and eugenol and extracted at intervals of time ranging from one hour to 36 days after cavity preparation.

2. Definite injury to the pulp was observed in all teeth extracted after 24 hours. The inflammatory lesions in "with-spray" teeth were limited to the regions underlying cut dentinal tubules. Extensive damage or abscess formation were present in "nonspray" specimens only.

3. Evidence of resolution or repair indicated that the potential for recovery was enhanced in the "with-spray" teeth.

11. Manley, E. A preliminary investigation into the reaction of the pulp to various filling materials. Brit. D. J. 60:321 April 1936.

12. Fish, E. Reaction of the dental pulp to peripheral injury of the dentine. Proc. Roy. Soc. London, Series B. 108:196 May 1931.

13. Johnson, Lent. Personal communication.

4. When the floor of the cavity was close to the pulp, less subsequent reaction or damage occurred in the "with-spray" specimens.

5. Theoretical explanation is offered for the observation of displaced cells in the dentinal tubules. The phenomenon is apparently caused by an increase of the intrapulpal pressure which forces these cells into the dentinal tubules.

Endodontic therapy with para-aminotoluene sulfonamide hydrochloride (Benzylog)

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In the fall of 1947, Casey and co-workers[1] introduced to the dental profession para-aminotoluene sulfondiethylamide, a new drug for use as a sterilizing agent in endodontic treatment. Some time after that disclosure, it was found that the parent compound, para-aminotoluene sulfonamide hydrochloride, performed in a manner superior to that of its derivative; hence, subsequent work has been conducted solely on the simpler compound.

This report concerns primarily the clinical behavior of para-aminotoluene sulfonamide when it is used as an endodontic antiseptic. In the development of this drug and the mode of its use an attempt has been made to produce an endodontic therapeutic agent which is as close as possible to the ideal agent. As postulated by Ostrander,[2] an ideal endodontic antiseptic should possess some eight or nine prime requirements. We are in substantial agreement with his belief, but we believe that such an agent should have several additional essential characteristics. A more complete list of the characteristics of an ideal endodontic antiseptic would include maximum germicidal spectrum, maximum penetration, fast action, maximum stability, low fastness potential and practical office utility. The agent should be nontoxic, nonstaining, odorless and tasteless, active in organic matter, nonsensitizing and economical and present minimum culture problems.

This study was carried out by the department of research and the clinic, Chicago College of Dental Surgery, Loyola University.

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‖Assistant professor of endodontics, Chicago College of Dental Surgery, Loyola University.

¶Administrative assistant, department of therapeutics, Chicago College of Dental Surgery, Loyola University.

1. Casey, G. J.; Gurney, B. F., and Rapp, G. W. Benzylog: A new drug and its clinical application. Bur 47:108 Dec. 1947.

2. Ostrander, F. D. Some basic requirements of successful root canal therapy. J. Canad. D. A. 20:183 April 1954.

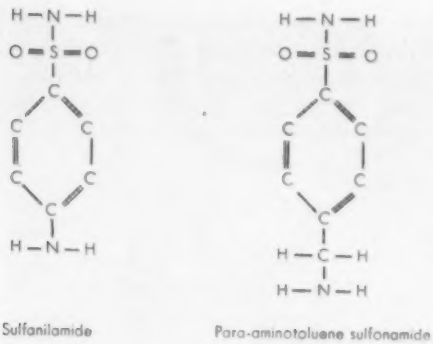

Fig. 1 • Molecular relationship of sulfanilamide and para-aminotoluene sulfonamide

It has been our goal to develop an endodontic antiseptic which incorporates as many of these desirable features as possible and as few of the undesirable features usually associated with such an agent as possible.

The chemical relation of para-aminotoluene sulfonamide to sulfanilamide is shown in Figure 1. The importance of the methylene group between the amino group and the benzene ring is readily apparent when the antibacterial behavior of this substance is considered.

Totally unlike the usual sulfonamides, this substance is highly active even in the presence of para-aminobenzoic acid, a known inhibitor of the common sulfonamides, and active also in the presence of para-aminomethyl benzoic acid.[3] It has a wide antibacterial spectrum.[4] The bacterial spectrum of para-aminotoluene sulfonamide is as follows: *Clostridium histolyticum, Cl. septicum, Cl. welchii, Cl. tetani, Cl. novyi and Cl. chauvaei; Micrococcus (Staphylococcus) pyogenes* var. *aureus* (hemolytic and nonhemolytic) and *M. pyogenes* var. *albus* (hemolytic and nonhemolytic); alpha and beta hemolytic streptococci and nonhemolytic streptococci; *Streptococcus faecalis, Str. lactis and Str. viridans; Bacillus coli; Proteus vulgaris; Pseudomonas aeruginosa;* Klebsiella; and diptheroids. It is active without reason in the presence of pus and necrotic tissue exudate, is frequently effective against bacterial strains which are resistant to the usual sulfonamides[5] and is superior to them in activity, especially against anaerobic microorganisms.[6]

Bacteriostasis can result if the concentration used is sufficiently low.[7] Bactericidal activity, however, is the result if a sufficiently high concentration is used.[8] At bactericidal concentrations, the necessary exposure time is relatively short, approximately ten minutes.[8]

Para-aminotoluene sulfonamide is not effective against all of the organisms in the list at all times, even at the usual bactericidal concentrations.[5] It has very little if any effect on oral yeasts or fungi.[9] It is rapidly destroyed by an amino-oxidase enzyme which is present in blood,[10] and hence is relatively ineffective when there is hemorrhage.

The tendency toward the development of bacterial resistance by strains that were originally susceptible is of a very low order; such resistant strains, however, can be produced with diligent effort.[11]

Tests of para-aminotoluene sulfonamide indicate that its toxicity is of a

3. Lawrence, C. A. In vitro studies of the antibacterial actions of para-aminoethylbenzenesulfonamide derivatives. J. Bact. 49:149 Feb. 1945.

4. Goetchius, G. R., and Lawrence, C. A. Antibacterial activity of some sulfon- and sulfanilanilide derivatives. J. Lab. & Clin. Med. 32:1361, 1947.

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7 Schreiber, H. W. Über der Mechanismus der Protosilwirkung. Zschr. Kinderh. 62:648 May 1941.

8. Howes, E. L. Local chemotherapy of wounds; tissue toxicity of certain antibacterial substances. Surg., Gynec. & Obst. 83:1 July 1946.

9. Moloy, Howard C. Sulfamylon in the treatment of chronic vaginal discharge associated with sterility. New York M. J. 50:992 April 15, 1950.

10. Hartles, R. L., and Williams, R. T. Metabolism of sulphonamides; relation of metabolic fate of ambemide (marfanil) and V335 to their lack of systemic antibacterial activity. Biochem. J. 41:206 1947.

11. Akiba, T., and Iwata, K. Bacteriological studies on p-amino-methyl-benzenesulfonamide (marfanil) derivatives, chiefly about p-amino-methyl-benzenesulfone. Jap. J. Exper. Med. 21:63 April 1951.

very low order and is comparable to that of penicillin.[12] By comparison, quaternary bases, parachlorophenol and streptomycin exhibit toxicities well above that shown by the homosulfonamide.[8] Irritation tests on animals and humans bear out these conclusions.[13]

Ingestion of large amounts of this drug by humans can cause nausea, headache, minor vertigo and perhaps some mental confusion, but no other signs of toxicity are apparent even at autopsy.[14] Experimental animals at autopsy show no signs of systemic toxicity from ingestion of this drug.[8]

MATERIALS AND PREPARATIONS

With the cooperation of the clinic of Loyola University Dental School, it was established early in this investigation that matters would be greatly facilitated if both a solution of the drug for rinsing debris from root canals and a drug-impregnated paper point for insertion into root canals as an antiseptic dressing were made available. In addition, the solution was to be used for wetting the inserted impregnated point, since it was found that such a procedure greatly enhanced the antiseptic action of the dressing. After the initial trials, it appeared that the optimum solution concentration was an isotonic one. The solution of the homosulfonamide supplied to the clinic was both sterile (autoclaved) and isotonic.

Sterile impregnated paper points were prepared as follows:

A weighed portion of the para-aminotoluene sulfonamide hydrochloride was dissolved in slightly more than an equal weight of hot sterile (autoclaved) distilled water in a sterile container with a cover. The mixture was warmed carefully into solution, and the mixture was boiled gently in the closed, covered vessel for not less than ten minutes and until a short cooling period indicated that the solution had reached supersaturation.

By means of a hot sterile Luer syringe and needle, an aliquot of this solution was transferred as rapidly and as aseptically as possible to the sterile paper points arranged properly in a sterile Petri dish. Immediately after impregnation and prior to the onset of crystallization, the treated points were placed under reduced pressure for a few minutes and then were allowed to return to atmospheric pressure. Afterward they were dried to constant weight over any of the common desiccants.

When so prepared, the impregnated paper points assume the white color of the drug, exhibit a greatly augmented longitudinal crushing strength and are chemically and therapeutically stable in wide ranges of temperature and humidity for almost an indefinite period of time.

CLINICAL ASPECTS

The method of treatment for a typical nonvital tooth was as follows:

First sitting: After the area was isolated with the aid of a rubber dam, workable access to the pulp chamber was gained by the removal of all carious dentin from the cavity. By careful use of a broach, access was gained to the apical region of the canal, which was then thoroughly flushed with a sterile solution of the homosulfonamide. A sterile impregnated point of the maximum allowable proportions was inserted into the canal as far as possible, the point tip being as close to the apex as possible. Any excess remaining outside of the pulp cavity was then removed by means of sterile scissors and forceps. The impregnated point was moistened well with the sterile isotonic solution of para-aminotoluene sulfonamide, the exposed end was folded into the pulp cavity and

12. Jacoby, F. Toxicity of marfanil and V187 to cells in vitro. Lancet 250:494 April 6, 1946.

13. Clark, W. B. Local use of "sulfamylon" (para-[amino-methyl]-benzene sulfonamide hydrochloride). Arch. Ophth. 38:682 Nov. 1947.

14. Rutledge, R. C., Jr., and Heideman, M. L., Jr. Oral and subcutaneous administration of p-aminomethylbenzenesulfonamide (sulfamylon). J. Pediat. 33:274 Sept. 1948.

against the cavity wall, a pledget of cotton saturated with homosulfonamide solution was placed over the folded end of the point, and the cavity was sealed for a period of, usually, 3 to 14 days. Close attention was given to the cavity seal to insure that there would be no leakage into the pulp cavity of any oral liquids.

Second sitting: In general, the technic advocated by Coolidge[15] was followed. A culture was taken, the canal was enlarged for possible filling and flushed with copious amounts of the sterile isotonic solution, and another impregnated point was sealed in as before.

The culture sample was obtained by the insertion of a plain sterile paper point into the canal after the removal of the impregnated paper point used as a dressing. After approximately one minute, the point was withdrawn and examined for exudate. If some was visible, then the point was dropped into sterile culture broth (brain heart infusion or nutrient broth), and the culture sample was placed in the incubator. If no exudate was visible, the point was discarded, and another sterile paper point that previously had been moistened with sterile culture broth was inserted into the canal and allowed to remain for approximately a minute. It was then withdrawn and placed in culture broth for incubation.

A culture was considered positive if the medium had changed in any way during the 72-hour incubation period. If no change in appearance of the broth had taken place, then the culture was considered negative. Decision as to whether the culture was negative or positive was reserved for members of the faculty.

Since the possibility exists of inhibition of bacterial growth in the culture broth through transfer of trace amounts of paraaminotoluene sulfonamide to the culture broth, careful consideration was given this factor. Experimental conditions and treatment conditions were so balanced that we are reasonably certain from a recent study that contamination of the culture broth by carry-over of the homosulfonamide on the culture sample is at a minimum.

If pulp death was believed to have occurred in such a fashion that oral bacteria had no access to the root canal, then an aseptic technic was used from the beginning of treatment and a culture sample was taken then, as well as after later treatments. Otherwise, no culture sample was taken until the first treatment had been completed.

Negative cultures obtained at two successive treatments were required before a nonvital canal was filled and sealed and one negative culture was required for a tooth with a vital pulp, before the canal was closed and sealed.

CLINICAL RESULTS

Of the several thousand instances in which successful endodontic treatment has been performed with the use of paraaminotoluene sulfonamide in the clinic of the Loyola University Dental School since 1948, only those for which a reasonably complete follow-up report is available, are reported.

Results in the 139 instances of endodontic treatment of nonvital teeth are shown in a bar graph, in which the percentages of instances in which a certain number of endodontic treatments were given before negative cultures were obtained at two consecutive treatments are shown (Fig. 2, left).

Figure 2, right, shows the results of endodontic treatment in 227 instances in which the pulp was vital. The percentages of instances in this group in which one negative culture was obtained after the stated number of treatments are given. The percentages of instances that were considered failures in the groups are given separately in each graph.

15. Coolidge, E. D. Endodontia; the clinical pathology and treatment of the dental pulp and pulpless tooth. Philadelphia, Lea and Febiger, 1950, p. 163-164.

DISCUSSION

A glance at Figure 2, left, will show that about 60 per cent of all gangrenous instances treated yielded consecutive negative cultures in the first two treatments; 87 per cent of the cases (60 per cent plus 14 per cent plus 13 per cent) had yielded two consecutive negative cultures by the end of the fourth treatment, and 95 per cent of the instances (87 per cent plus 8 per cent) had yielded two consecutive negative cultures by the end of the fifth treatment. In some of the instances the condition was more stubborn, and six or seven treatments were required before two consecutive negative cultures were obtained. There were some instances of outright failure. The exact causative agent of these failures was not determined at this time.

Success achieved in treating teeth with vital pulps is equally encouraging. A glance at Figure 2, right, shows that in more than 80 per cent of the instances sterilization occurred at the first treatment, in 93 per cent (83 per cent plus 10 per cent) sterilization was achieved by the end of two treatments, and in 97 per cent (93 per cent plus 4 per cent) sterilization had occurred by the end of the third treatment. There were a few instances in which the condition was stubborn and required more treatments, and there were some instances of failure. As in the first group, no attempt was made at the time to determine the cause of the failure. Since para-aminotoluene sulfonamide is not

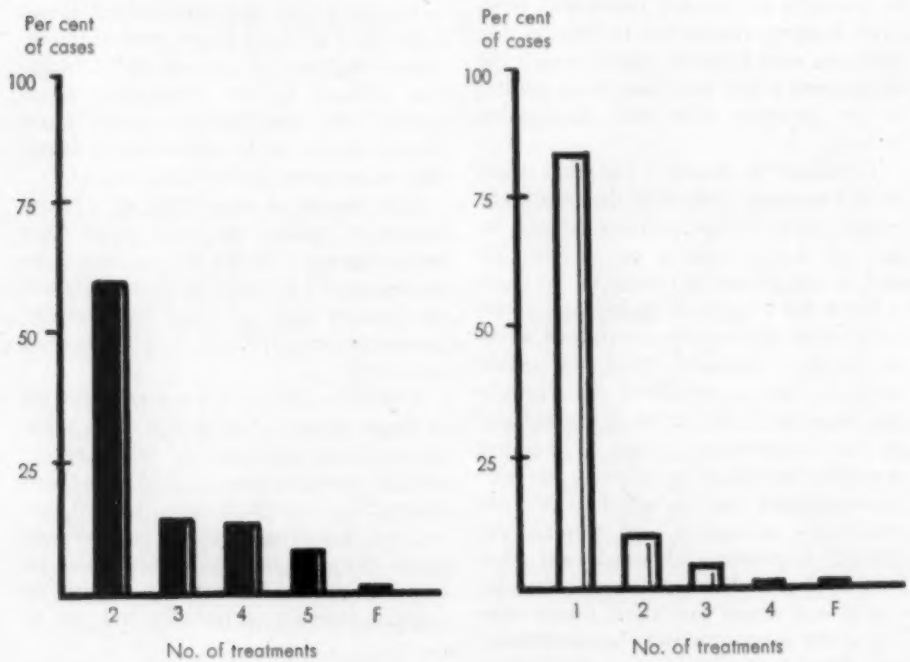


Fig. 2 • Left: Graph showing percentages of cases and number of treatments required before negative cultures were obtained at two consecutive treatments in 139 instances of endodontic treatment of teeth with nonvital pulps. Right: Graph showing percentages of cases and number of treatments required before one negative culture was obtained in 227 instances of endodontic treatment of teeth with vital pulps. "F" denotes percentage of failures in each group

Fig. 3 • Roentgenograms showing typical tissue repair after use of para-aminotoluene sulfonamide as endodontic antiseptic. Left: Before treatment. Right: Six months after treatment

active against all the bacteria that may be found in an infected root canal, however, it seems reasonable to assume that infection with bacteria against which the drug is not active may have been present in the instances that were therapeutic failures.

It should be pointed out that these figures represent primarily the results obtained with clinical patients treated by student dentists under our instruction and, hence, should be viewed in this light.

Since the success of endodontic treatment is not necessarily determined when the tooth is sterilized, filled and sealed properly, but is associated with proper and desirable repair in the periapical and surrounding alveolar regions, we of course exerted every effort to maintain periodic examination of patients who had received endodontic treatment. In general, the clinical impression obtained was that growth of granulation tissue and alveolar repair was about one third faster than when the more common, nonantibiotic, endodontic antiseptics were used. Typical roentgenograms taken before treatment and six months after treatment are shown in Figure 3.

It has been shown that sensitization of a patient to antibiotics or the elicitation of a sensitivity reaction can occur during the execution of endodontic treatment.[16,17] Being aware of this, we have been watchful to detect any symptoms, subjective or clinical, that would indicate the development or existence of sensitivity in clinical patients. At no time have we detected any such indications. Sensitization of a patient to para-aminotoluene sulfonamide has occurred when other forms of administration have been employed.[18] Therefore, sensitization from endodontic treatment might occur.

CONCLUSIONS

The results of clinical treatment in 139 instances of teeth with gangrenous pulps have been presented. A solution of para-aminotoluene sulfonamide and impregnated points was used as described. It was found that in about 95 per cent of the instances sterilization was successful (negative cultures in two consecutive treatments) after the fifth treatment. These results appear to be considerably better than those given in the initial report.[1]

The results of treatment of 227 instances of teeth with vital pulps have been presented. Under the conditions described, in 83 per cent of these instances sterilization was achieved by the first treatment; and in 97 per cent by the third treatment.

From the clinician's standpoint, the use of paper points impregnated with para-aminotoluene sulfonamide begins to approach a nearly ideal endodontic treatment. The technic is easily carried out, has no handling hazards or problems other than maintenance of asepsis, requires no special instruments, requires no unusual training or technics and can be

16. Schmidt, G. Penicillin reaction in endodontic treatment. J.A.D.A. 52:196 Feb. 1956.

17. Bender, I. B., and Seltzer, S. Combination of antibiotics and fungicides used in treatment of the infected pulpless tooth. J.A.D.A. 45:293 Sept. 1952.

18. Waltner, J. G., and White, W. R. Topical medication in otology. New York M. J. 50:2421 Oct. 15, 1950.

done by the average dentist in the average dental office. The impregnated points and the aqueous solution are stable regardless of room temperature or humidity. The impregnated points yield the drug readily, as it is water soluble, and therapeutic concentrations are produced immediately when the points are used as has been described.

The presence of acid conditions, as might arise from ingredients in a temporary filling, have almost no deleterious effect on the homosulfonamide since it exerts its therapeutic effects even in conditions of low pH.[18] The wide antibacterial spectrum of para-aminotoluene sulfonamide, its marked activity especially against the anaerobes, its ability to remain active in the presence of pus or necrotic tissue exudate, its ability to remain active in the presence of para-aminobenzoic acid whether from metabolic origin or from hydrolysis of procaine-type anesthetics, its prompt action, its very low tissue toxicity and its very low sensitization potential make this agent a desirable and relatively effective antiseptic for root canal treatment.

Effect of vitamin C on skeletal fluoride storage in the guinea pig

Joseph C. Muhler, D.D.S., Ph.D., Bloomington, Ind.

Previous work by Phillips and co-workers[1-3] has suggested that fluoride may be related to the metabolic activity of vitamin C. These workers have shown that in dairy cows suffering from chronic fluorosis, the amount of vitamin C increases in certain tissues, and that the cellular respiration of the adrenal cortex is depressed whereas the level of anaerobic respiration is considerably increased. Phillips and Chang[3] noted that the vitamin C content of the adrenal glands of rats receiving 680 ppm of fluoride (as sodium fluoride) was approximately twice that of the control animals not receiving extra fluorides. Furthermore, Phillips has demonstrated in experiments with acutely toxic doses of sodium fluoride (900 micrograms fluoride per milliliter) that orange juice will prolong the survival period of young growing rats. Therefore, it became of interest to learn whether vitamin C might be an important factor affecting the retention of fluoride in the skeleton of the rat. These studies were designed to provide evidence concerning this relation.

EXPERIMENTAL

Throughout this study young male guinea pigs weighing between 170 and 190 Gm. were used. In all instances the animals received fluoride-free drinking water (F = 0.01 micrograms per milliliter) *ad libitum* and the same vitamin C-deficient diet composed of ground oats, 59 per

Department of chemistry, Indiana University.

1. Phillips, P. H. Manifestation of scurvy-like symptoms induced by ingestion of sodium fluoride. J. Biol. Chem. 100:79 May 1933.

2. Phillips, P. H., and Stare, F. J. Distribution of reducing substance (vitamin C) in tissues of fluorine-fed cows. J. Biol. Chem. 104:351 Feb. 1934.

3. Phillips, P. H., and Chang, C. Y. Influence of chronic fluorosis upon vitamin C in certain organs of rats. J. Biol. Chem. 105:405 May 1934.

Table 1 • Comparison between the amount of fluoride found in the carcass of the guinea pig when fed varying amounts of vitamin C and fluoride

Duration of experiment (days)	No. of animals	Fluorine dosage (mg./day)	Vit. C dosage (mg./day)	Mean final weight of animals (Gm.)	Whole carcass fluorine analysis	
					Conc. (μg./Gm.)	Total (mg.)
			Series 1			
20	4	0	0	153.0	319.1	1.74
20	4	0	25	169.2	244.3	1.48
20	4	0	100	164.0	383.0	2.20
20	5	0.1	0	165.8	521.6	3.03
20	5	0.1	25	171.8	526.5	3.35
			Series 2			
23	6	0	0	155.2	317.0	1.91
23	6	0	25	240.4	587.0	4.15
23	6	0	125	261.8	629.2	5.44
23	6	2	0	150.6	3,683.0	21.87
23	6	2	25	249.9	3,679.0	30.48
23	6	2	125	244.7	3,756.1	30.10
			Series 3			
24	8	0.2	0	115.5	953.0	4.32
24	8	0.2	50	149.2	1,092.0	5.65
24	8	0.2	M.D.*	150.0	893.0	4.80
64	6	0.2	50	220.0	1,293.0	9.34
64	6	0.2	M.D.	159.5	1,630.0	8.34
120	5	0.2	50	143.0	1,433.0	21.05
120	6	0.2	M.D.	149.8	—	18.44

*Received lowest minimal dosage that would maintain a steady increase in body weight as compared with the group receiving 50 mg. of ascorbic acid. The amount varied with age, beginning with 1 mg. at the start and steadily increasing to 5 mg. at the termination of the experiment.

cent; powdered skim milk (heated at 110° C. until brown), 30 per cent; Wesson oil, 8 per cent; cod liver oil, 2 per cent; and sodium chloride, 1.0 per cent. The fluoride content of this diet was approximately 3.0 micrograms per gram. All of the guinea pigs were housed individually in large wooden cages in an air-conditioned room.

The experiment was divided into four series, differing from one another with regard to the amount of vitamin C and fluoride the animals received. The experimental plan of the individual series of studies is indicated in Tables 1 and 2. In all instances, every guinea pig received the prescribed amount of vitamin C or fluoride daily. In order to be sure that identical amounts were received by every animal in a respective series, the supple-

Table 2 • A comparison of the amount of fluoride retained in the sternum, femur, heart, kidney and carcass of male guinea pigs receiving 0.5 mg. of fluorine daily and ascorbic acid (Series 4).

Group	Heart	Kidney	Skeletal analysis			
			Sternum	Femur	Whole carcass	
	(μg F/Gm. of wet weight)		(mg.)	(mg.)	(μg/Gm.)	(mg.)
1 (50 mg. vit. C)	26.55*	163.9* ±18†	0.273* ±0.03	2.97* ±0.6	6,465	75.55‡ ±8
2 (min. dosage vit. C)	20.53	124.9 ±24	0.211 ±0.02	2.50 ±0.6	5,705	58.01 ±6

*Significantly different from group 2 at the 0.05 level of confidence.
†Standard deviation.
‡Significantly different from group 2 at the 0.02 level of confidence.

ments were administered orally by use of graduated eyedroppers. After a short period, the animals would quickly and easily consume the supplement and the problem of spillage was almost completely eliminated.

After the duration of each series, the animals were sacrificed by ether, the skin was removed, and the entire carcass was analyzed for fluorine by methods previously described.[4]

DATA AND DISCUSSION

The results of these studies are presented in Table 1. As shown in series 1, those animals which received 100 mg. of vitamin C daily and no added fluoride have numerically more fluorine in their carcasses than similar animals receiving no vitamin C, although the differences are not significant. When the animals received 0.1 mg. of fluoride daily in addition to 25 mg. of vitamin C, there was more fluoride in their carcasses than when similar animals received the same amount of fluoride but no vitamin C. Similar conclusions are obvious when the data obtained from the animals in series 2 are compared. When no vitamin C or fluoride was given, there was considerably less fluoride in the skeleton than when 125 mg. of vitamin C and no fluoride was given daily.

These conclusions are strengthened by the data obtained when the same levels of vitamin C were fed in addition to 2.0 mg. of fluoride daily. When 25 or 125 mg. of vitamin C was provided along with 2.0 mg. of fluoride, there was approximately 30 per cent more fluoride in the skeleton than when a similar amount of fluoride was given with no vitamin C. Since there were considerable weight differences in the animals receiving ascorbic acid in relation to those receiving no ascorbic acid, however, these differences must be considered doubtful.

In the series 3 animals, additional confirmation is found for the fact that vitamin C appears to increase the amount of fluoride in the skeleton. In this series, all of the animals were given the same amount of fluoride daily, and the only variable aside from the duration of the experiment was the amount of vitamin C supplement provided. It will be noted from Table 1 that when no vitamin C was provided, the total carcass contained 4.32 mg. of fluoride. When a minimum amount of vitamin C was provided so that a constant increase in body weight was maintained (this amount of vitamin C varied according to the weight of the animal, but it never exceeded 5.0 mg. a day nor was it ever less than 1.0 mg. a day), 4.80 mg. of fluoride was found in the carcass. This is an increase of approximately 10 per cent.

When 50 mg. of vitamin C was given, 5.65 mg. of fluoride was found in the carcass, this being an increase in carcass-fluoride storage of approximately 24 per cent when a comparison is made with similar animals receiving no vitamin C. After 64 and 120 days on the experiment, similar conclusions were evident. In the former instance, there was approximately 11 per cent and in the latter, 13 per cent more fluoride in the animals receiving 50 mg. of vitamin C than similar animals receiving only the lowest supplement of vitamin C.

Thus, in three separate experiments it was shown that added vitamin C appears to increase directionally the amount of fluoride retained by the guinea pig skeleton. However, only in the series 2 animals were these differences significant. Furthermore, since there were considerable differences in the skeletal size of the animals receiving ascorbic acid in relation to those not receiving ascorbic acid, the effect of this factor on skeletal retention needs careful investigation before it can be stated definitely that ascorbic acid in-

4. Weddle, D. A., and Muhler, J. C. Effects of inorganic salts on fluorine storage in rat. J. Nutrition 54:437 Nov. 1954.

fluences skeletal fluoride retention. These data presented here, however, were taken from typical experiments, conducted at different times; all indicated similar directional tendencies of the same effect.

From the data presented it is not actually possible to state that an increased amount of fluoride was found in the skeleton, since the whole animal was ashed for analysis. Thus, a more accurate description of these findings may be that the ascorbic acid caused an increased deposition of fluoride in the carcass of the rat. It would be helpful, then, to know exactly if the presence of ascorbic acid is associated with an increased amount of fluoride in the soft tissues as well as in the skeleton.

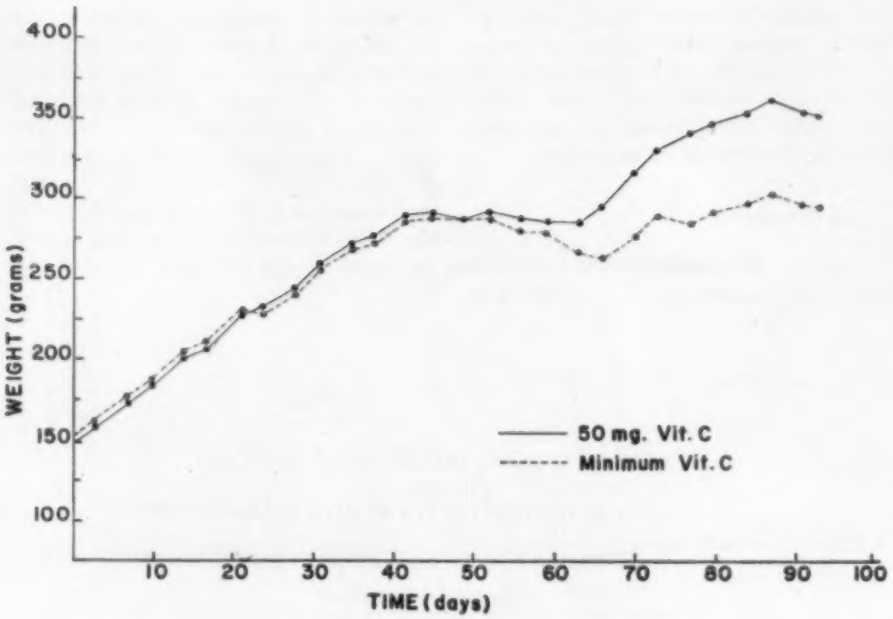
Evidence suggests that there is a great variation in the rate of deposition of fluoride in the skeleton and that large quantities of fluoride promptly go into the skeleton after its ingestion. Many variables, such as the concentration of fluoride ingested, its chemical form, duration of administration, previous experience with the element, and still other factors undoubtedly affect its deposition and turnover. However, as saturation of the bones is approached, more of the ingested fluoride undoubtedly will be found in the soft tissues. This fluoride found in the soft tissue is probably the cause, then, of fluorosis and should be determined accurately in such studies as these.

In order to study this problem another experiment, series 4, was designed. Twenty male guinea pigs, all weighing between 170 and 180 Gm., were divided into two groups. Each of the two groups was divided into ten pairs in order to maintain as accurately as possible the same body weight increase between the groups receiving the high and low levels of ascorbic acid respectively. Group 1 received 50 mg. of ascorbic acid daily and Group 2 a minimum amount of ascorbic acid daily, this amount being the smallest level that would permit weight increase equal to that of the paired mate receiving 50 mg. of ascorbic acid. The amount of ascorbic acid the Group 2 animals received varied considerably, but at no time did it ever exceed 10 mg. per day per animal. During the first ten days of the experiment, each animal received 3 mg. per day, and 5 mg. per day for the following 30 days. During the next 23 days they received 7 mg. and for the duration of the experiment, or for the last 30 days, they received 10 mg. In addition, all of the animals received 0.5 mg. of fluoride, as sodium fluoride daily.

The illustration shows the daily weight increases of the two groups and indicates that during the first 60 days of the study the weight gains were almost identical. During the last 23 days the Group 2 animals failed to gain as much as those of Group 1 even though they were receiving 10 mg. of ascorbic acid per animal per day. The administration of the ascorbic acid and fluoride, as well as the diet received and the housing conditions, was identical to that described earlier with the exception that the duration of the experiment was 93 days.

The fluoride content of the various tissues of the animals in this experiment can be found in Table 2, and it is again demonstrated that the animals which receive the higher levels of ascorbic acid deposit more fluoride in the carcass than similar guinea pigs which are maintained on the minimum dosage level. The difference is significant at the 0.02 level of confidence. Similarly both the femur and the sternum contain more fluoride when the animals receive the higher levels of ascorbic acid. Of considerable interest are the values for the heart and kidney, both of which show similar results to those found when the whole carcass or the femur or sternum is analyzed.

Thus, in four separate experiments conducted at different times, the presence of added dietary vitamin C is associated with an increased deposition of fluoride in the carcass of the guinea pig. These findings seem to differ from the conclusions



Effect of two levels of ascorbic acid on the weight gain in male guinea pigs receiving 0.5 mg. of fluoride (as sodium fluoride) daily

reached by Phillips and his co-workers who reported that added vitamin C appeared to prolong the survival period of rats receiving toxic levels of fluoride, provided increased storage is indicative of increased toxicity.

In another sense, however, they may confirm the studies of Phillips. There are at least two ways in which the body detoxifies fluoride; one is through excretion by the urine, and the second is by deposition in the skeleton. If deposition in the skeleton is viewed as a means of detoxifying fluoride, then these data may well explain the findings of Phillips and his co-workers. Retention by the skeleton may be one of the protective mechanisms employed by the animal against the toxicity of fluoride. However, as skeletal saturation of fluoride is approached, less and less of the element will be deposited in the bones and more and more will be found in the soft tissues. This latter point is of such importance that much additional work is needed in order to clarify the conditions under which it takes place.

From the data obtained in this study, it appears that the ingestion of 50 mg. of ascorbic acid daily is associated with an increased storage of fluoride by the kidney and the heart. Additional work is indicated in this area in order to clarify the amount of fluoride that goes into the soft tissues in relation to the amount present in the skeleton. Since a different approach was used in this study than in those reported by Phillips and co-workers, however, and since the guinea pig and not the rat was used, one cannot actually compare the two studies.

Since much emphasis is being placed on proper nutrition in young children, which of necessity involves attempts at maintaining the proper amount of vitamin C intake, and since communal fluoridation is steadily gaining support as an acceptable means of reducing the incidence of tooth decay in children, it is felt

that additional studies in this area are needed. Perhaps there may be a scheme in which ascorbic acid would preferentially deposit fluoride in the bones, and if this is true, it represents an important aspect of nutritional investigation.

CONCLUSIONS

Increasing the amount of vitamin C intake in the guinea pig is associated with an increased storage of fluoride in the carcass. This increased carcass storage is evident if no extra dietary fluoride is provided, or if amounts ranging from 0.1 mg. to 2.0 mg. of fluoride per day are given. The reason for this increased fluoride retention is not known, but may be the result of differences in the size of the skeleton between the animals receiving ascorbic acid and those not receiving it.

In vitro studies on effect of furfural, hydroxymethylfurfural and tobacco smoke on demineralized and noncarious human teeth

Samuel Dreizen, D.D.S.; Jo G. Dreizen, B.A.; Charles N. Spirakis, M.A., and Tom D. Spies, M.D., Chicago

The yellow-brown pigment associated with human dental caries has long excited the interest of the dental profession.[1] Gottlieb[2] considered the discoloration an integral part of the caries lesion. The pigment was isolated and identified as a melanoidin by Deakins[3] in 1941. Seven years later it was produced experimentally by Dreizen, Greene, Carson and Spies.[4] The chemical composition was found to be similar to, if not identical with, that recovered from carious teeth.[5] For the past eight years, various aspects of the mechanism of pigment formation in dental caries have been studied intensively in this laboratory. Studies dealing with melanoidin formation by the interaction between bacterial degradation products of glucose and the proteins of the teeth have been published.[6-8] These have been extended to determine whether selected chemical decomposition products of carbohydrates formed during the baking and boiling of foods and during the

From the department of nutrition and metabolism, Northwestern University Medical School.

1. Van Reenen, J. F. Tobacco: the effects of its use with special reference to the mouth and dental elements. J.D.A. South Africa 9:334 Oct. 1954.

2. Gottlieb, B. A new concept of the caries problem and its clinical application. J.A.D.A. 31:1489 Nov. 1944.

3. Deakins, M. Isolation of a melanin-like substance from carious organic matrix of human dentin. J. D. Res. 20:39 Feb. 1941.

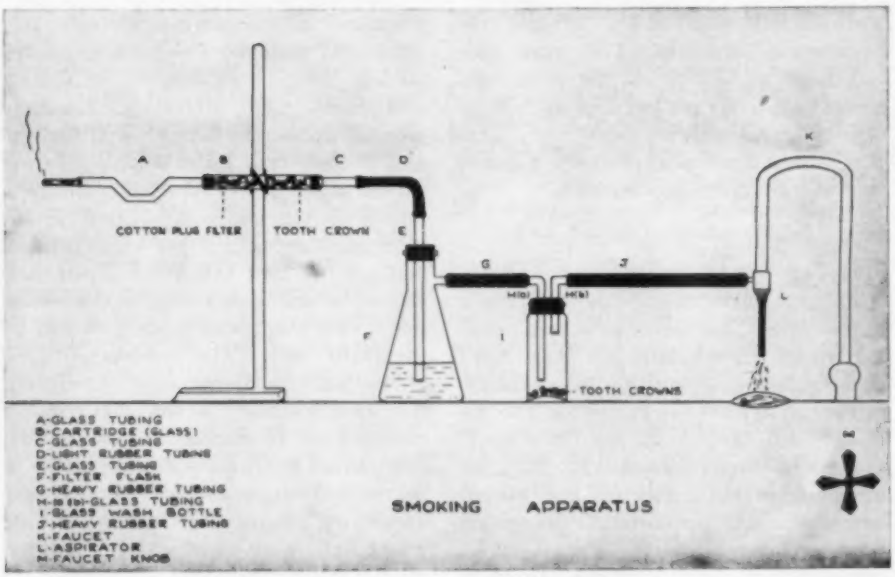
4. Dreizen, S., and others. In vitro production of a "yellow brown melanin-like pigment" in the organic matrix of noncarious human tooth crowns by methylglyoxal (pyruvic aldehyde) and acetol (acetyl carbinol). J. D. Res. 28:26 Feb. 1949.

5. Dreizen, S.; Greene, H. I., and Spies, T. D. Comparison of the chemical nature of a synthetically produced pigment and the naturally occurring pigment associated with dental caries. Oral Surg., Oral Med. & Oral Path. 2:922 July 1949.

6. Dreizen, S., and Spies, T. D. Note on the production of a yellow-brown pigment in the organic matrices of noncarious human teeth by oral lactobacilli. Oral Surg., Oral Med. & Oral Path. 3:686 May 1950.

7. Dreizen, S., and Spies, T. D. Decalcification and discoloration of intact noncarious human tooth crowns by an oral strain of lactobacilli. Oral Surg., Oral Med. & Oral Path. 4:388 March 1951.

8. Dreizen, S., and others. Experimental observations on melanoidin formation in human carious teeth. J. D. Res. 36:233 April 1957.



Smoking apparatus used in study

burning of tobacco condense with the proteins of teeth to yield melanoidins. The substances tested were furfural, hydroxymethylfurfural and tobacco smoke.

MATERIALS AND METHODS

Thirty-six noncarious human teeth extracted because of advanced periodontal disease were cleansed of debris and sectioned at the anatomical necks. Each crown was covered with melted baseplate wax except for an opening approximately 3 by 3 mm. that exposed the enamel on the labial or buccal surface. The 36 crowns were arbitrarily divided into three groups of 12 each. The first group was demineralized in 5 per cent hydrochloric acid (HCl), the second was demineralized in 1 molar disodium ethylenediamine tetraacetic acid (EDTA) adjusted to pH 7.4 with sodium hydroxide and the third was untreated. A set of six crowns (2 HCl demineralized, 2 EDTA demineralized and 2 untreated) was placed in the "cartridge" of the smoking apparatus shown in the illustration. A second set identical in composition was placed in the "dry trap." The crowns were subjected to the smoke from 30 king-size cigarettes drawn through the apparatus intermittently at a rate of a 3 second aspiration each 30 seconds. The procedure was repeated with another group of 12 crowns distributed as already mentioned, exposed this time to the smoke from 30 king-size filter tip cigarettes. The cigarettes used in these studies were popular commercial brands. Each of the 24 tooth crowns was examined grossly and microscopically for the presence of a yellow-brown pigmentation. They were then subjected to the chemical test for melanin-like compounds described by Deakins.[8]

The remaining 12 crowns were divided into four groups each containing 1 HCl demineralized, 1 EDTA demineralized and 1 untreated crown. One member from each group was added to tubes containing 5 ml. of either 0.5 per cent furfural, 1.0 per cent furfural, 0.5 per cent

hydroxymethylfurfural and 1.0 per cent hydroxymethylfurfural. The tubes were incubated at 37° C. and the crowns inspected each day for ten days for a color change in the exposed part. They were then tested for a yellow-brown pigment by the aforementioned methods.

OBSERVATIONS

A definite yellow discoloration appeared in the exposed portion of each demineralized crown contained in the "cartridge" of the smoking apparatus after aspiration of the smoke from five cigarettes. The demineralized crowns in the "dry trap" showed a similar color change after smoke from ten cigarettes had passed over them. The discoloration progressed from yellow through orange-yellow, orange-brown and ultimately to deep brown as smoking was continued. The exposed portion of the crowns not treated with either hydrochloric acid or disodium ethylenediamine tetraacetic acid developed a moist yellowish film which was readily removed by washing with distilled water. In contrast, the discoloration in the demineralized crowns appeared as an integral part of the tooth structure and was completely insoluble in distilled water even after vigorous washing. The sequence of color changes in the HCl and EDTA-treated crowns was identical with both the regular and filter tip cigarettes. Microscopic examination of ground sections prepared from the crowns placed in the path of the tobacco smoke showed that the pigmentation in the demineralized parts followed the course of the dentinal tubules. No such pigment was noted in the sections from the intact tooth crowns. After complete decalcification prior to testing for melanin-like compounds, the pigment was seen to be confined to the organic matrix of the tooth structure. With Deakins' test,[8] black insoluble pigment granules were recovered from the crowns treated with hydrochloric acid or disodium ethylenediamine tetraacetic acid, whereas no insoluble pigment was obtained from the untreated crowns.

The HCl and EDTA-demineralized crowns exposed to 0.5 per cent furfural and 0.5 per cent hydroxymethylfurfural turned yellow on the fourth day and were brown by the tenth day. Those in the tubes containing 1.0 per cent furfural and 1.0 per cent hydroxymethylfurfural showed an initial yellowing on the second day which progressed to deep brown by the fifth day. The undemineralized crowns did not change color throughout the experimental period. Microscopic examination of sections from the demineralized teeth showed penetration of the yellow-brown discoloration into the underlying dentin. The sections of the intact teeth were pigment free. The test for melanin-like pigment was positive for the HCl and EDTA-treated crowns and negative for the untreated crowns exposed to the dilute solutions of furfural and hydroxymethylfurfural.

DISCUSSION

Furfural and hydroxymethylfurfural, hydrolytic decomposition products of hexoses and pentoses, are frequently formed during the heating of carbohydrate foods. Furfural has also been shown to be a constituent of tobacco smoke.[9] Both products, furfural and hydroxymethylfurfural, are known to combine chemically with some proteins and other amino compounds to form melanoidins.[10,11] The present findings show that the fraction of human tooth structure remaining after demineralization readily combines with either furfural or hydroxymethylfurfural to yield highly stable insoluble color com-

9. Bogen, E. Composition of cigarets and cigaret smoke. J.A.M.A. 93:1110 Oct. 12, 1929.

10. Rice, R. G.; Kertesz, Z. I., and Stotz, E. H. Color formation in furfural systems. J. Am. Chem. Soc. 69:1798, 1947.

11. Wolfrom, M. S.; Schuetz, R. D., and Cavalieri, L. F. Chemical interactions of amino compounds and sugars. IV. Significance of furan derivatives in color formation. J. Am. Chem. Soc. 71:3518, 1949.

plexes with properties consistent with those of melanoidins. Under the present investigative conditions, browning of the dental proteins was a two-stage process. Prior demineralization of the involved tooth structure was essential for pigment formation. Both "denatured" and "undenatured" proteins responded in identical fashion denoting that acid decalcification of tooth structure is not a deterrent to pigment production in the caries lesion. The observations are in accord with the hypothesis that the basic mechanism in the formation of the yellow-brown discoloration in human dental caries involves a chemical interaction between carbohydrates and proteins.

SUMMARY AND CONCLUSIONS

Studies were made which showed that demineralized human tooth crowns undergo "browning" in the presence of furfural, hydroxymethylfurfural and tobacco smoke in contrast to undemineralized crowns which are not permanently discolored by treatment under identical experimental conditions. The browning results from a condensation between furfural or hydroxymethylfurfural and the proteins exposed by demineralization of tooth structure. The pigment thus formed appears identical with the yellow-brown pigment which characterizes caries lesions in human teeth.

Physical properties of chromium-cobalt dental alloys

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The first patent on the chromium-cobalt alloys was obtained by Elwood Haynes in 1907.[1] It was not until 1937, however, that R. W. Erdle and C. H. Prange of the Austenal Laboratories perfected the materials and technics for the use of these alloys in dental applications.[2] Since their introduction into dentistry, the chromium-cobalt alloys have made steady gains in popularity until, at present, the great majority of all partial dentures are made of material of this type. This increased use can be attributed to their low density, low material cost, and high modulus of elasticity in comparison with that of gold alloys.

This paper gives the results of tests of the physical properties of six commercial alloys obtained by use of specimens comparable in size to dental appliances. The properties determined were: tensile strength, modulus of elasticity, yield strength, per cent elongation, superficial hardness, and liquidus temperature. (In this study, liquidus temperature is defined as the lowest temperature at which the alloys are completely liquid.)

Several studies of these alloys have

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†Guest worker, U. S. Army, dental research section, National Bureau of Standards.

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1. Haynes, Elwood. U. S. Patent 873,745, Dec. 17, 1907.

2. Personal communication from authors. See also Prange, C. H. U. S. Patent 1,909,008, May 16, 1933. Erdle, R. W., and Prange, C. H. U. S. Patent 1,956,278, April 24, 1934. Prange, C. H. U. S. Patent 1,958,466, May 15, 1934.

been made in relation to their dental application. In addition to the work of Erdle and Prange, Paffenbarger, Caul and Dickson[3] at the National Bureau of Standards and Bush, Ingersoll and Peyton[4] at the University of Michigan have made special contributions to the field. The manufacturers of commercial dental alloys have compiled significant data on their own products. It was felt, however, that additional information was required to define the properties to be expected of currently available products and to serve as the basis for a proposed specification for these materials. It was also thought desirable to investigate the reported superiority of the threaded enlarged-end specimen over the straight rod specimen for tensile tests of these materials and to compare the properties of specimens of these materials as cast by various laboratories under what they ostensibly believe to be the best conditions.

The six alloys tested include five American products and one popular European alloy. The American materials were selected to give a representative sample of the products on the market at the present time. The group included new products as well as established products which had been tested previously. The European alloy selected has been used with some success by the armed forces in Europe and is believed to be typical of the better products available there.

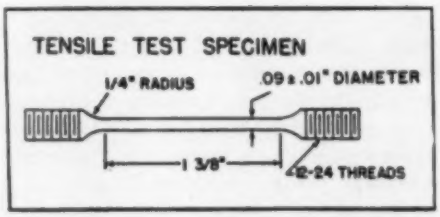

Fig. 1 • Specimen design for tensile test

These products can be divided into two classes on the basis of their composition. The first, containing approximately 60 per cent cobalt and the second, less than 45 per cent cobalt. Table 1 shows the composition of the alloys tested. Of the two alloys with less than 45 per cent cobalt, the one with the high iron content, (Alloy C), has been withdrawn from the market since the start of this project.

Table 1 • Chemical composition of chromium-cobalt dental alloys

Alloy		A*	B*	C*	D*	E†	F†
Cobalt	%	43.5	59.4	29.7	62.6	61.5	65.0
Chromium	%	21.6	30.3	22.3	26.2	27.6	30.0
Molybdenum	%	7.0	5.8	3.3	5.0	5.3	4.0
Nickel	%	20.1	1.5	0.7	2.3	2.3	—
Iron	%	0.25	0.7	40.0	1.0	1.6	—
Silicon	%	0.35	0.55	1.7	0.55	‡	—
Tungsten	%	—	0.35	—	1.2	—	—
Manganese	%	3.0	0.34	0.9	0.16	0.8	—
Copper	%	3.5	—	—	0.20	—	—
Beryllium	%	0.9	—	—	—	—	—
Carbon	%	0.05	N.D.§	N.D.§	0.25	‡	—
Others	%	—	—	—	—	1.0‡	1.0‖

*Analyzed at National Bureau of Standards.
†Reported by manufacturer.
‡Reported under "Others" as total Si, C, Al.
§No determination.
‖Unspecified additions

EXPERIMENTAL PROCEDURE

In the course of this study, two types of specimens were employed. In the preliminary investigation, cast rods 0.09 in. in diameter and 5 to 6 in. in length were used; however, with this specimen design it was difficult to produce complete castings without interior porosity. Bush, Ingersoll and Peyton developed a threaded enlarged-end specimen design resembling the A.S.T.M. standard specimen but of a size corresponding more closely to dental applications. This specimen, as adapted for this study, consisted of a 0.09 ± 0.01 in. diameter rod, filleted to 12-24 threads at each end (Fig. 1). Wax patterns were made at the National Bureau of Stand-

3. Paffenbarger, G. C., and Dickson, George. Base metal alloys for oral restorations. J.A.D.A. 30:852 June 1943.

4. Bush, S. H.; Ingersoll, C. E., and Peyton, F. A. Navy contract N6-onr-232 Progress Reports, School of Dentistry, University of Michigan.

ards and distributed to the various laboratories which prepared specimens for use in the investigation. The specimens were cast according to the method normally employed in each laboratory. The resulting castings were then submitted to the National Bureau of Standards where all testing was done. Except for alloy F (the European product), castings were made by the manufacturers of each alloy, the Central Dental Laboratory of Walter Reed Army Medical Center, Fifth Army Central Dental Laboratory at Saint Louis, dental division of the 7100th USAF Hospital, and the dental research section of the National Bureau of Standards.

The tensile properties were determined on a 2,000-pound capacity pendulum-type testing machine. The head speed employed was 0.02 in. per minute on the driven head, equivalent to a loading rate of 12,500 psi per minute in the elastic range. The strain was read from two Tuckerman optical strain gauges by means of an autocollimator. Figure 2 shows the tensile specimen in the testing machine grips with the Tuckerman gauges mounted opposite each other.

A load, approximately equivalent to a stress of 10,000 psi, was applied to the specimen and the strain read. The load was then increased to that equivalent to 50,000 psi and the strain again recorded. Thereafter the load was applied continuously and the strain was recorded at 25 pound load increments (approximately 4,000 psi) up to 500 pounds. The gauges were then removed and loading was resumed at the same rate until the specimen failed.

The modulus of elasticity was calculated on the basis of the total strain between the stresses of 10,000 and 50,000 psi.

The yield strength, for purposes of this study, was defined as the higher stress of the first stress increment (approximately 4,000 psi) that produced a strain equal to or greater than 1.25 times that produced by an equal increment below 50,000 psi.

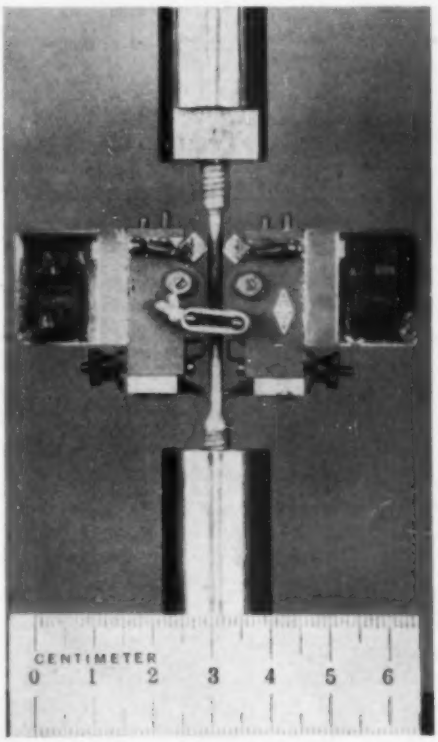

Fig. 2 • Tensile specimen in testing machine grips showing mounting of strain gauges

A one-inch gauge length was used for the determination of the amount of elongation. The length between the gauge marks was measured to the nearest 0.002 in. both before testing and after reassembly following fracture.

The Rockwell 30N hardness was determined on specimens of the type used for the tensile test. Parallel flats were wet ground on opposite sides of the specimen. The use of a coolant during the grinding operation is essential in order to avoid changes in the hardness that otherwise would result from the heat produced by the grinding. The brale indenter and 30 kilogram load employed in the Rockwell 30N test produce small

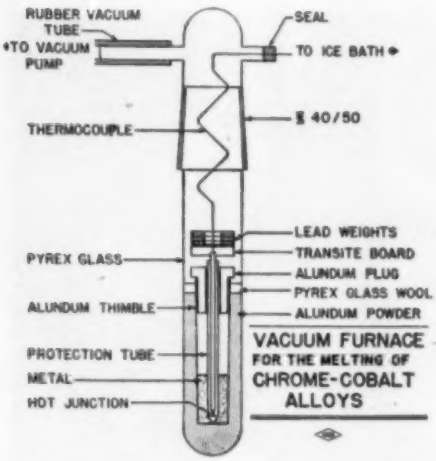

Fig. 3 • Schematic drawing of vacuum furnace for the induction melting of small specimens

enough indentations to allow a series of indentations along the longitudinal axis of the ground specimen in both the threaded and the rod portions. A study was made of the relative hardness so determined on specimens as cast and on the fragments of the specimens broken in the tensile test.

These materials, like most alloys, exhibit a melting range rather than a definite melting point. Because these alloys are to be cast, the liquidus temperature, the lowest temperature at which they are completely liquid, is of practical importance. Liquidus temperatures were determined using samples of approximately 35 Gm. of the alloy. These materials react very rapidly with oxygen at high temperatures, and it is necessary to protect them during the prolonged heating required for accurate determinations. Commercial practice employs protective slags and short melting cycles, neither of which could be employed in this instance. Since contamination can also occur from the refractories, they must be selected with care. Graphite, for example, must be excluded from the system to prevent the absorption of carbon by reaction with carbide-forming components. Vacuum melting was found to be superior to controlled atmospheres of nitrogen or argon in supplying the melt with the surface protection that slags provide in commercial melting practice.

The melting was done in a high frequency induction furnace which permitted rapid heating and produced a stirring action which assisted in maintaining the homogeneity of the molten metal. The chrome-cobalt alloy in small ingots was held in a 19 mm. (outer diameter) x 90 mm. alundum thimble. This was enclosed in a 35 mm. (inner diameter) Pyrex envelope and the intervening space was filled with 90 mesh alundum powder (Fig. 3). The upper portion of the tube held a platinum-platinum rhodium thermocouple coiled and weighted in such a manner as to allow the protection tube containing the hot junction to move downward as the metal melted. An alundum plug covered the top of the thimble and acted as a guide through which the protection tube passed. The thermocouple passed through a seal in the upper portion of the glass to an ice-bath cold junction, and the resulting potential was measured on a potentiometer readable to 0.001 millivolt (Fig. 4). The liquidus temperature was obtained from several cooling curves on each of two or more specimens of each alloy. The thermocouple was calibrated at the freezing points of copper and of Mond nickel.

DISCUSSION OF RESULTS

The physical properties of cast tensile specimens are dependent on many factors and show considerable variation among the alloys tested. The resultant stress-strain curve, however, is typical of most nonferrous materials. Figure 5, taken from a representative test of a clinically acceptable alloy, shows the generally favorable properties attained with these alloys. The modulus of elasticity was about 28,500,000 psi, which is approxi-

mately twice that of gold alloys. The yield strength was about 70,000 psi and, since no constant stress yielding was observed, some arbitrarily selected method must be chosen for its calculation. The method employed was one that has been used for cast gold alloys.[5] The tensile strength was approximately 105,000 psi.

In addition to the variation in properties that occurs between different alloys, considerable variation can occur in the measured properties for a single alloy when cast under different conditions. Table 2 shows the range of values obtained on alloy A for rod specimens cast by the manufacturer, and for threaded specimens cast by three separate laboratories each using their own technics and procedures. The observed variation probably results from such factors as burn-out procedure, sprue size and arrangement, and melting and casting technic.

Similar variation in the properties of alloy B are shown in Table 3. In this instance, the difference in modulus of elasticity for indiviudal specimens is particularly noteworthy. This property normally is not affected much by variations in processing, but in these two lots of castings, the individual modulus values ranged from 23.1 x 10^6 to 33.1 x 10^6 psi. This has been attributed to a tendency which this alloy has of forming grains approximating the diameter of the specimen used in this study. The wide range in the results can then be explained on the basis of anisotropy of the individual grains and

5. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T. Inlay casting golds: physical properties and specifications. J.A.D.A. 19:36 Jan. 1932.

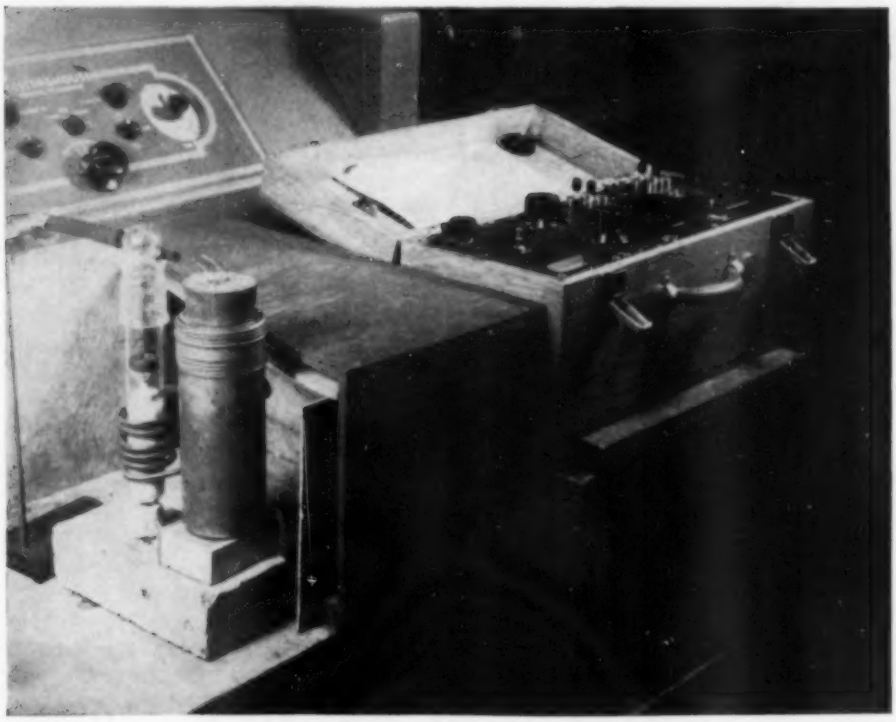

Fig. 4 • Apparatus employed for liquidus temperature determinations

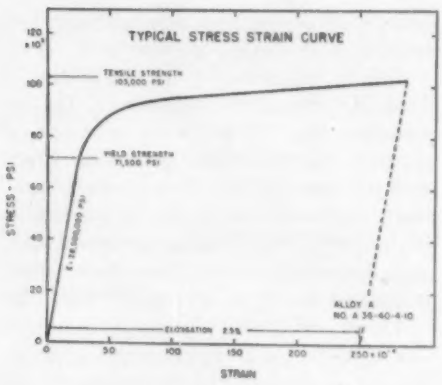

Fig. 5 • Stress-strain curve for typical tensile specimen

their orientation relative to the specimen axis.

Table 4 gives the data for six alloys tested. All values were determined as described earlier except those for alloy F which were determined in accordance with the proposed specification[6] for these products. This specification employs a combined test for yield strength and modulus of elasticity similar to that in the federal and American Dental Association specifications for casting golds.[7,8] As a result, the reported value of 60,000 psi yield strength is a minimum value only, and the 29.0 x 10^6 psi modulus is a minimum value which is exact only if none of the specimens tested had proportional limits below 60,000 psi.

The composition of alloys E and F as given in Table 1 are those reported by the manufacturers. Chemical composition for alloys A-D was determined by analyses made on the specimens employed in the tensile tests, and represent the composition of the metal actually cast rather than that of the alloy as received from the manufacturer. Considering the melt-

6. Taylor, D. F., and Sweeney, W. T. Proposed specification for dental chromium-cobalt casting alloys. J.A.D.A. 54:44 Jan. 1957.

7. Federal Specification QQ-G-540, March 1940. Gold; casting, inlay, dental.

8. Council on Dental Research, American Dental Association. American Dental Association specifications for dental materials, specification no. 5: dental inlay casting golds. Chicago, American Dental Association, 1956.

Table 2 • Mechanical properties of alloy A as cast by different laboratories

Type of specimen	Rod	Threaded		
Laboratory	Manufacturer	CDL-WR*	NBS	CDL-St. L.†
Number of specimens	4	10	5	11
Modulus of elasticity				
Mean value (psi)	32.5 x 10^6‡	28.0 x 10^6	28.5 x 10^6	25.5 x 10^6
σ § (psi)	3.0 x 10^6	1.0 x 10^6	2.5 x 10^6	1.5 x 10^6
C. V.‖ (per cent)	9.0	3.0	8.5	6.5
Yield strength				
Mean value (psi)	60,500‡	65,000	64,000	64,000
σ (psi)	8,000	4,500	5,500	2,500
C. V. (per cent)	13.0	7.0	8.5	4.0
Tensile strength				
Mean value (psi)	96,500‡	108,000	94,500	115,500
σ (psi)	4,000	7,500	11,500	9,500
C. V. (per cent)	4.0	7.0	12.0	8.5
Elongation				
(1 in. gauge length)				
Mean value (per cent)	1.8‡	2.9	1.2	4.0
σ (per cent)	1.1	1.3	—	2.2
C. V. (per cent)	60.0	45.0	—	55.0

*Central Dental Laboratory of Walter Reed Army Medical Center.
†Fifth Army Central Dental Laboratory at St. Louis.
‡2-in. gauge length.
§Standard deviation.
‖Coefficient of variation

ing practices employed, however, the differences are expected to be small.

The analytical methods employed have been described.[9-11] No attempt was made to make any correlation of the observed properties with composition. The number of compositions tested was small in relation to the number of elements present, so such a correlation would be of little value. In addition, there is good evidence in the results that other factors are of equal or greater importance. Examination of Table 1 shows that alloys D and E are of very similar composition, whereas Table 4 shows extreme variation in their properties, tensile strength and per cent of elongation in particular.

Rockwell Superficial Hardness (30N) was determined for each alloy along the entire length, both rod and threaded portions, of specimens used in the tensile test. This aided in the comparison of various spruing arrangements as regards their ability to prevent formation of shrinkage porosity. As can be noted from Table 4, the results indicated a consistently higher hardness for the rod portion than for the threaded ends. This may be attributed to two possible causes, work hardening of the rod portion during the tensile test, or to structural differences in the two regions resulting from differences in their cooling rates. In order to determine which of these was the proper explanation, a series of hardness tests was performed on specimens which had not been tested in tension. The results are compared with those for previously pulled specimens in Table 5. It can be seen that there is no significant difference between the two groups.

In all probability, the small amount of elongation obtained in these alloys is insufficient to produce work hardening except in the immediate region of fracture. The observed difference in hardness between the rod and threaded portions of the specimens, therefore, is attributed to differences in grain size and distribution of microconstituents. On the basis of these observations, it is concluded that hardnesses can be determined on the specimens after they have been tensile tested without introducing additional error.

Table 3 • Mechanical properties of alloy B, as cast by different laboratories

Threaded specimens			
Laboratory		CDL-WR*	Manufacturer
Number of specimens		8	9
Modulus of elasticity			
Mean value	(psi)	31.0×10^6	28.0×10^6
σ	†(psi)	1.2×10^6	2.5×10^6
C. V.	‡(per cent)	3.5	9.0
Yield strength			
Mean value	(psi)	65,500	57,000
σ	(psi)	4,500	3,500
C. V.	(per cent)	7.0	6.0
Tensile strength			
Mean value	(psi)	117,500	98,000
σ	(psi)	9,500	6,000
C. V.	(per cent)	8.0	6.0
Elongation (1-in. gauge length)			
Mean value	(per cent)	1.2	4.3
σ	(per cent)	0.2	1.7
C. V.	(per cent)	18.0	40.0

*Central Dental Laboratory, Walter Reed Army Medical Center.
†Standard deviation.
‡Coefficient of variation.

A certain number of specimens were examined metallographically but, aside from the typical dendritic nature of the microstructures, no features were produced with sufficient regularity to permit correlation of structure with observed properties. This lack of correlation is a logical result of the wide range of casting procedures employed by the participating laboratories.

The liquidus temperature of the alloys tested falls into two groups apparently

9. Hague, J. L.; Maczkowske, E. E., and Bright, H. A. Determination of nickel, manganese, cobalt, and iron in high temperature alloys, using anion-exchange separations. J. Research NBS 53:353 Dec. 1954.

10. Lundell, G. E. F.; Hoffman, J. I., and Bright, H. A. Chemical analysis of iron and steel. New York, John Wiley & Sons, 1931.

11. ASTM methods of chemical analysis of metals. Philadelphia, American Society for Testing Materials, 1950.

Table 4 • Mechanical properties of chromium-cobalt dental alloys. Average of all threaded specimens

Alloy		A		B		C		D		E		F
Number of specimens		26		17		6		5		18		9
Modulus of elasticity												
Mean value	(psi)	28.0×10^6		29.5×10^6		26.0×10^6		27.5×10^6		28.5×10^6		29.0×10^6
σ *	(psi)	2.0×10^6		2.5×10^6		1.5×10^6		2.5×10^6		3.5×10^6		1.0×10^6
C. V.†	(per cent)	7.0		8.0		6.5		9.5		12.0		4.0
Yield strength												
Mean value	(psi)	64,500		61,000		49,500		56,000		62,400		60,000†‡
σ	(psi)	4,500		7,000		8,000		4,000		3,000		—
C. V.	(per cent)	7.0		11.5		16.5		7.0		5.0		—
Tensile strength												
Mean value	(psi)	108,500		107,500		104,000		84,500		102,500		105,100
σ	(psi)	12,000		12,500		8,500		4,000		10,000		6,500
C. V.	(per cent)	11.0		11.5		8.0		5.0		10.0		6.0
Elongation (1 in. gauge length)												
Mean value	(per cent)	3.4		3.2		2.7		6.0		1.9		1.9
σ	(per cent)	1.9		2.1		1.5		2.9		0.8		0.9
C. V.	(per cent)	55.0		65.0		56.0		48.0		40.0		47.0
Hardness (R 30N)		a	b	a	b	a	b	a	b	a	b	a
Mean value		53.0	47.0	60.0	57.0	54.0	49.0	51.0	49.0	55.0	51.0	58.0
σ		2.0	4.5	1.0	1.5	1.5	1.0	1.0	1.5	0.5	1.0	1.5
C. V.	(per cent)	4.0	9.5	2.0	2.5	3.0	2.0	2.0	3.0	1.0	2.0	2.5

*Standard deviation.
†Coefficient of variation.
‡Minimum value in accordance with proposed specification.
a—Rod portion.
b—Threaded portion.

correlated with their cobalt content (Table 6). Alloys B, D, E and F, all containing approximately 60 per cent cobalt, have liquidus temperatures between 2,560° and 2,650°F.; whereas alloy A, containing 43.5 per cent cobalt, has a liquidus temperature of 2,355°F. Alloy C had been withdrawn from the market, and no sample was available at the time the liquidus temperature determinations were made. The accuracy of the determined values for the liquidus temperature is believed to be within ± 10°F., and to be somewhat better in most instances. In instances where the desirability of greater accuracy would justify the use of larger specimens and greater expenditure of effort, the methods reported by Roeser and Wensel[12] are recommended.

12. Roeser, W. F., and Wensel, H. T. Methods of testing thermocouples and thermocouple materials. J. Research NBS 14:247 March 1935.

Table 5 • Effect of prior tensile testing on hardness

Alloy	As cast		After tensile test	
	Rod portion	Threaded portion	Rod portion	Threaded portion
A	53.0	47.0	54.0	52.0
B	60.0	57.0	60.0	60.0
C	54.0	49.0	50.0	48.0
E	55.0	51.0	54.0	53.0

All values are average Rockwell 30N hardness.

Table 6 • Liquidus temperature of chromium-cobalt dental alloys

Alloy	Liquidus °F.
A	2,355
B	2,605
D	2,575
E	2,650*
F	2,560

*As reported by manufacturer.

SUMMARY

The tensile strength, modulus of elasticity, yield strength, per cent elongation, superficial hardness, and liquidus temperature were determined for a series of six commercial chromium-cobalt base dental casting alloys. The average tensile properties of these alloys fell within the following ranges: tensile strength 84,500-108,500 psi, modulus of elasticity 26.0-29.5 x 10^6 psi, yield strength 49,500-64,500 psi, and the elongation 1.9-6.0 per cent. The average Rockwell 30N hardness of the alloys tested ranged from 47.0 to 60.0. The liquidus temperatures of the alloys ranged from 2,355° to 2,650°F.

Threaded enlarged-end specimens were found to give more consistent values than straight rods in the tensile test. The rod portion of the threaded specimen was found to be work hardened so little by the tensile test that the same specimen can be employed for the tensile test and the determination of hardness.

Roentgen-ray doses in dental roentgenography

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In dental roentgenography it is desirable to use technics that require the smallest amount of radiation to produce roentgenograms of the highest diagnostic quality.

It should be emphasized that the only reason for exposing the dental patient to any roentgen-ray radiation should be to obtain the maximum amount of diagnostic information regarding his dental health. The utilization of technics that require very small amounts of radiation to produce roentgenograms of only mediocre quality is as undesirable as technics that require unnecessarily large amounts of radiation to produce roentgenograms of high quality.

This paper will report a study which was made to determine the effect that each of several technical factors had on the doses of roentgen-ray radiation that reached the dental patient.

Any attempt to compare the doses resulting from the use of one roentgenographic technic with that when another technic was used must be based on the premise that the resulting roentgenograms are equal or similar in some respect.

The range of densities that emulsions of dental films can produce extends from about 0.3 to well over 3.0. The lower figure represents the density found in clear unexposed areas of roentgenograms, whereas the upper limit is found in black, overexposed areas. However, the useful range of densities that can be viewed successfully with many illuminators or view boxes extends approximately from 0.3 to 2.6. Measurements were made of typical dental roentgenograms to determine the ranges of density for various dental structures and materials (Table 1).

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Associate professor of dentistry, School of Dentistry, University of Michigan.

Table 1 • Ranges of density for various dental structures and materials as measured in typical roentgenograms

Structure	Approximate range of density
Metallic fillings	0.3–0.5
Enamel	0.5–0.8
Dentin	0.7–1.0
Bone	0.7–2.0
Pulpal chamber	1.0–1.2
Gingival tissue	2.0–2.2
Background	2.4–2.6

It was decided arbitrarily that two roentgenograms, produced by different technics, would be considered equal or similar when a certain part of a standard object for testing recorded with a density of 1.0 on each roentgenogram. The standard object employed was an aluminum step-wedge of 99.99 per cent purity. The step-wedge ranged in thickness from 1.0 to 20.0 mm., in 1 mm. steps. The 8.0 mm. step was selected as the one to yield a density of 1.

When dental x-ray machines are operated on a 60-cycle current, roentgen rays are given off only during half of each alternation of the current. Hence, for each second that the x-ray machine is operating, 60 brief exposures are made, each of 1/120 second in duration.

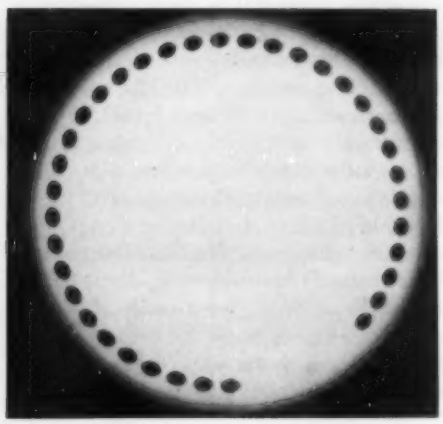

Fig. 1 • Calibration of timer. Roentgenogram of rotating disk of lead with small hole located near its edge. When timer was set to operate for 0.75 seconds, 36 images of the hole were recorded. Actual length of time that x-ray machine had functioned was 36 divided by 60, or 0.6 seconds

The timers of the x-ray machines used in this study were calibrated carefully by directing the beam at a stationary film located beneath a rotating disk of lead which contained a small hole near its circumference. All of the roentgenographic film, located beneath the rotating lead disk, was protected from the roentgen rays except for the area of film that was under the small hole in the lead disk. Since both the disk and hole moved constantly, the small area of film lying beneath the hole changed constantly, and each time that the roentgen rays were generated for 1/120 second, a new area of film was exposed followed by an unexposed area when the roentgen rays were off for 1/120 second. The determination of the actual number of seconds that the x-ray machine was operating, as opposed to the number indicated on the timer, required dividing by 60 the number of exposed areas on the resulting roentgenogram (Fig. 1).

The method used in this study for determining the effect of a change in technic on the time of exposure was as follows:

Both technics that were under investigation were used to make numerous roentgenograms with different times of exposure of a pure aluminum step-wedge. The ratio of the two exposures that finally produced roentgenograms exhibiting density 1 for the 8.0 mm. step of the step-wedge was considered to be the factor for converting the time of exposure used with one technic to the appropriate time of exposure for the second technic. Throughout this investigation, an effort was made to hold all factors constant except those under investigation.

The factor for converting times of exposure for Radia-Tized film to Ultra-Speed film was found to be 0.21. Figure 2 illustrates the density and differences

in contrast between the two films. The Ultra-Speed film displayed more grain and less contrast than the other film. The greater granularity of the Ultra-Speed film was not objectionable when viewed with the unaided eye. Even the highest densities produced by this fast film were discernible when the roentgenograms were viewed with light from an ordinary view box. The two fastest films available at present are DuPont Lightning Fast and Kodak Ultra-Speed. They were found to be very similar in all respects. They are vastly improved over previous high-speed dental films, and, undoubtedly, more advances in higher speeds and smaller grain size will occur in the future.

The factor for converting times of exposure for films developed for three minutes in high-energy developing solutions at 68°F. to films developed for five minutes was found to be 0.80. The roentgenographic results were almost identical for this test.

The effect of prolonged time of development on density and contrast was investigated by making four identical exposures of a step-wedge of pure aluminum on identical films. The four films were developed at 68°F. in fresh, high-energy developer for 3, 6, 12 and 24 minutes. The density of each of the steps on the four roentgenograms was measured with a densitometer and is plotted in Figure 3. These results indicate that density, as a rule, increased with time of development. However, the densities of the thinner or less radiopaque structures became so high that they did not transmit a sufficient amount of light to be useful when the roentgenogram was viewed against a conventional source of light or view box.

Prolongation of the time of development also affected contrast. Contrast between the thinner or less radiopaque structures decreased greatly with increased time of development whereas the contrast between the other structures increased.

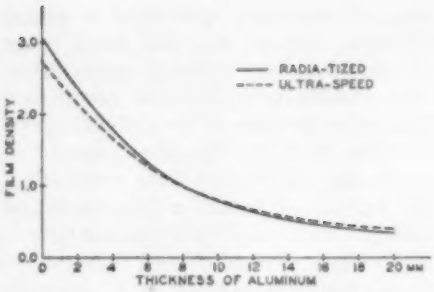

Fig. 2 • Film densities plotted against corresponding thicknesses of aluminum. Only 0.21 times as much exposure was needed with Ultra-Speed film as with Radia-Tized film, to cause 8.0 mm. of aluminum to record with density of 1.0. Technical factors: 65 kv.p., 10 ma., total filtration equivalent to 2.25 mm. of aluminum, three minute developing at 68°F.

Factors were determined for calculating the proper times of exposure to be used with various external or added filters. The measurements of densities achieved in these tests are plotted in Figure 4 and the conversion factors appear in Table 2.

It can be seen from Figure 4 that the highest contrast or the greatest difference in density between adjacent steps on a roentgenogram of the step-wedge was achieved when very little internal and no external filtration was present. This higher contrast held for all structures, but was noticeably greater in the ranges of density in the portion of the film showing the pulpal chamber, supporting bone and gingival tissue. However, this technic caused the first two steps to record with such high densities that they could not be distinguished with ordinary illumination. When 1.75 mm. of aluminum was used as added filtration, the contrast between the thinner or less radiopaque structures was reduced, whereas the contrast between the more radiopaque structures remained unchanged. The added filtration in this instance reduced the densities of the first two steps to a level where they too could be viewed with an ordinary source of light. When 0.35 mm. of copper plus 0.5

mm. of aluminum were used as added filtration, contrast over the entire range of densities was reduced appreciably. This combination filter did not permit full use to be made of the useful range of densities that the film was capable of portraying. How much these filters affect the amounts of radiation that the dental patient receives will be explained later.

The factor for converting times of exposure for films exposed at 65 kilovolts peak to films exposed at 90 kilovolts peak was found to be 0.36. The measurements of density made to determine this conversion factor are shown in Figure 5. At both voltages, a total filter, equivalent to 2.25 mm. of aluminum, was used. The slopes of the two curves in Figure 5 indicate that roentgenograms made with times of exposure adjusted for 90 kilovolts peak would have less contrast than if 65 kilovolts peak had been employed. The reduced contrast produced with 90 kilovolts peak was quite similar to that achieved with Ultra-Speed film (Fig. 2). However, the densities of the more radiopaque structures were slightly less with Ultra-Speed film and the contrast between these structures slightly higher.

There are two main categories of roentgen-ray radiation present in the dental

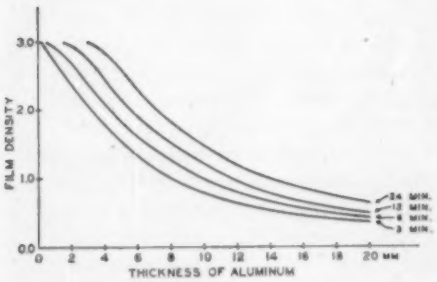

Fig. 3 • Four identical exposures were made of step-wedge composed of pure aluminum. One film was developed at 68°F. in fresh, high-energy developer for each of following number of minutes: 3, 6, 12 and 24. Resulting film densities are plotted against corresponding thicknesses of aluminum. Technical factors: 65 kv.p., 10 ma., total filtration equivalent to 2.25 mm. of aluminum

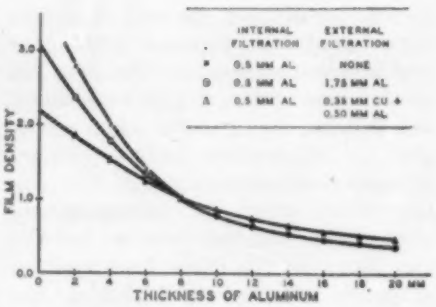

Fig. 4 • Film densities plotted against corresponding thicknesses of aluminum for three roentgenograms made with various amounts of external filtration. Times of exposure were adjusted to cause 8.0 mm. of aluminum to record with density of 1.0. Technical factors: 65 kv.p., 10 ma., inherent filtration equivalent to 0.5 mm. of aluminum, Radia-Tized film, three minute developing at 68°F.

office. One is the radiation that emerges as the primary roentgen-ray beam from the cone of the x-ray machine. The other is secondary radiation. The part of the patient that is irradiated by the primary beam becomes the most potent source of secondary radiation. Radiation that escapes from any portion of the head of the x-ray machine, except through the portal of the cone, is called leakage radiation. In most x-ray machines of fairly recent manufacture, the hazard of leakage radiation is not nearly the problem that it is with older machines. The housing of the head of the newer dental x-ray machines is designed so that the leakage radiation from the head of the x-ray machine[1] does not exceed 0.100 r per hour at a distance of one meter from the tube's target when the tube is operated at its maximum continuous-rated current for the maximum-rated voltage.

RADIATION OUTPUT

The internationally accepted unit roentgen (r) is defined as follows: "The roent-

1. U. S. Department of Commerce. X-ray protection. National Bureau of Standards Handbook 60. Washington, D. C., Government Printing Office, 1955.

gen (r) shall be the quantity of x- or gamma radiation such that the associated corpuscular emission per 0.001293 g of air, produces, in air, ions carrying 1 esu of quantity of electricity of either sign."[1] The milliroentgen (mr) is defined as "a submultiple of the roentgen equal to one-thousandth (1/1000) of a roentgen."[1]

With a 25 r Victoreen ionization chamber, the roentgen output per second was measured for an x-ray machine operated at 65 and 90 kilovolts peak. When operating the machine with a total filtration equivalent to 2.25 mm. of aluminum and 10 milliamperes of current, the output at 7.25 inches from the target was found to be 0.85 r per second at 65 kilovolts peak and 1.68 r per second at 90 kilovolts peak. Stated another way, approximately twice as much radiation was delivered per second at 90 kilovolts peak as at 65 kilovolts peak. In addition, the radiation generated at the higher voltage was more penetrating or harder in quality.

A roentgen-ray beam is composed of radiation of many wavelengths. Only the radiation of those wavelengths that can penetrate the subject and produce an effect on the film is useful. The nonuseful rays are absorbed by the patient and serve only to increase the dose to his skin. By placing a filter in the path of a roentgen-ray beam, much of the nonuseful radiation can be absorbed by the metal of the filter instead of by the patient. Unfortunately, some of the useful radiation also is stopped by the filter. Even though the time for exposure must be increased

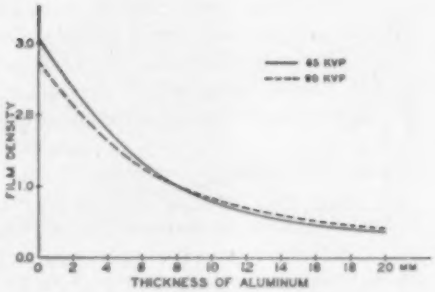

Fig. 5 • Film densities plotted against corresponding thicknesses of aluminum. Only 0.36 times as much exposure was needed with 90 kv.p. technic as with 65 kv.p. technic, to cause 8.0 mm. of aluminum to record with density of 1.0. Technical factors: 10 ma., total filtration equivalent to 2.25 mm. of aluminum, Radia-Tized film, three minute developing at 68°F.

to compensate for the absorption of some useful radiation by the filter, the dose to the skin of the patient is greatly reduced when a filter is used.

The radiation output of a dental x-ray machine with various filters is illustrated in Figure 6; it indicates that the greatest reduction of the rate at which radiation is put out by the machine is accomplished with the addition of 1 or 2 mm. of aluminum. Greater amounts of added filter produce progressively less effect on the output of the x-ray machine. The thicker filters also seriously decrease the contrast in the roentgenograms and require excessively long times of exposure.

Table 2 • Conversion factors (65 kv.p.)

Inherent filtration	External or added filtration	Relative exposure factors
0.5 mm. Al.	None	1.000
0.5 mm. Al.	1.75 mm. Al.	1.425
2.25 mm. Al.	None	1.425
0.5 mm. Al.	0.35 mm. Cu.+ 0.5 mm. Al.	5.1

SECONDARY RADIATION

Secondary radiation occurs whenever some substance is irradiated by primary radiation. Secondary radiation scatters in all directions from its point of origin.

An experiment was devised to determine whether or not secondary radiation follows the inverse-square law:

A four-inch diameter toy balloon filled with water was suspended in the path of the primary beam of a dental x-ray machine. The diameter of the beam at the center of the balloon was 3.6 inches. At

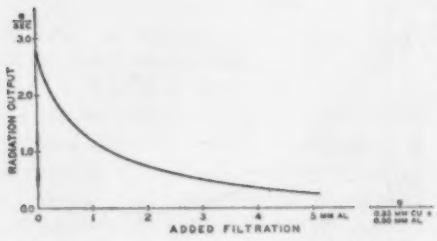

Fig. 6 • Radiation output of dental x-ray machine as function of external or added filtration. Technical factors: 65 kv.p., 10 ma., 7.25 in. from target to center of ionization chamber, inherent filtration equivalent to 0.5 mm. of aluminum

various distances from the balloon, measurements were made of the amount of scattered secondary radiation coming off at right angles to the direction of the central ray. These results are plotted in Figure 7 for distances ranging from 6 to 60 inches. Next, the inverse-square law was applied to the amount of scattered radiation measured at 12 inches in order to calculate the theoretical amounts that should be present at the other distances. These calculated values also appear in Figure 7. The small differences between the measured and calculated values indicate that secondary radiation closely follows the inverse-square law.

Similar tests with a water-filled balloon were made to determine the relative amounts of scattered radiation produced as a function of the voltage employed. The measurements were made two feet from the center of the balloon and perpendicular to the path of the central ray of the roentgen-ray beam. The results, appearing in Figure 8, indicate that the amount of scattered radiation increases with voltage, and almost two and one-half times as much scattered radiation is produced at 90 kilovolts peak as at 65 kilovolts peak.

As a substitute for a living head, and as a test object on which many exposures could be made without any fear of movement or biological damage, a human skull was filled and coated with wax to simulate the human features. The absorption and scattering of roentgen rays by this model or wax phantom checked out closely with that of living heads.

Tests were performed to determine the relative amounts of scattered radiation from the wax phantom as a function of filtration. The x-ray machine was operated at 65 kilovolts peak and 10 milliamperes with the short cone touching the cheek. The central ray was directed at the occlusal surfaces of the first molars and perpendicular to the median sagittal plane. The measurements were made in front of the phantom, three feet from, and perpendicular to, the path of the central ray of the beam. The results indicate that the amount of scattered radiation decreased with increasing filtration (Fig. 9).

Another series of experiments was performed with the phantom just described to determine the relative amount of scattered radiation from the wax phantom as a function of the diameter of the roentgen-ray beam. Only the inherent filtration of the machine, equivalent to 0.5 mm. of aluminum, was used. The results shown in Figure 10 indicate that the use of a lead diaphragm that reduced the diameter of the beam at the end of the short cone from 3.5 in. (9.64 sq. in.) to 2.75 in. (5.95 sq. in.) also reduced the scattered radiation by almost 30 per cent. The use of such a lead diaphragm is earnestly recommended.

Tests were made to determine the effect of voltage on the quality of the radiation generated by an x-ray machine equipped with total filtration equivalent to 2.25 mm. of aluminum. The quality of the radiation is expressed as the thickness of aluminum that must be placed in the path of the roentgen-ray beam to reduce its intensity by 50 per cent. This thickness of aluminum is known as the half-value layer (HVL). The results of these determinations of half-value layer as a function of voltage are contained in

Figure 11 and illustrate how the ability of the radiation to penetrate a substance increases with voltage.

DOSE TO FACIAL SKIN

The dose of roentgen-ray radiation that reaches the skin of the dental patient's face is the sum of the exposure by the primary roentgen-ray beam and by the radiation scattered back to the skin from underlying tissues. The contribution of the primary beam to the "skin-dose" is called the "air-dose." The air-dose can be measured by placing an ionization chamber at the same position in the roentgen-ray beam that the skin of the patient had occupied previously. The amount of "backscatter" would be the difference between the skin-dose and the air-dose.

To be accurate, measurements on the skin of the patient should be made with the ionization chamber half-embedded in the soft tissue. Since embedding the chamber in the patient was not feasible, Budowsky,[2] in his study of skin-doses in

2. Budowsky, J., and others. Radiation exposure to head and abdomen during oral roentgenography. J.A.D.A. 52:555 May 1956.

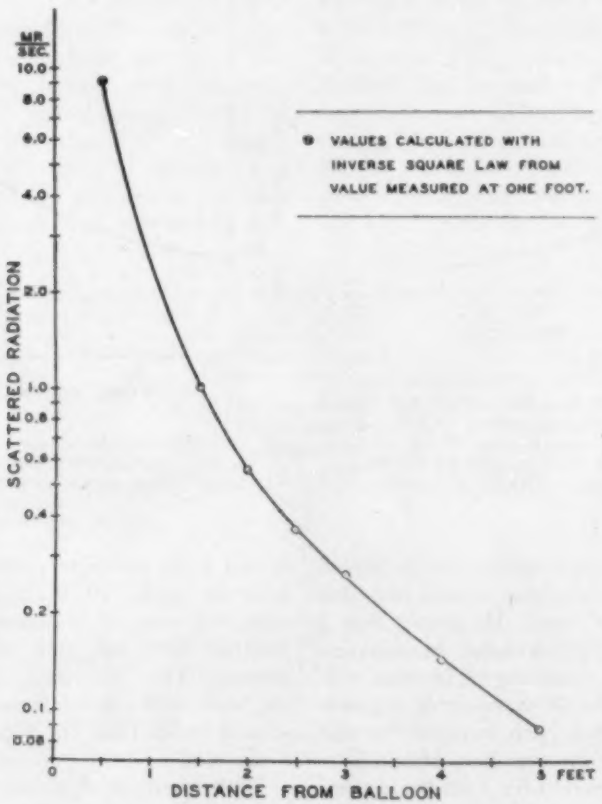

Fig. 7 • Measurements made at various distances of amount of scattered radiation given off from water-filled balloon at right angles to direction of central ray. Technical factors: 90 kv.p., 10 ma., total filtration equivalent to 2.25 mm. of aluminum

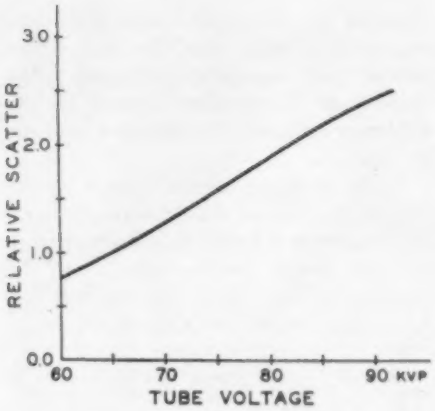

Fig. 8 • Relative amount of radiation scattered from water-filled balloon as function of tube voltage. Technical factors: 10 ma., total filtration equivalent to 2.25 mm. of aluminum

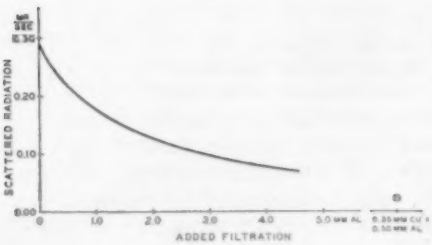

Fig. 9 • Amount of radiation scattered from human skull (which had been filled and coated with wax) as function of external or added filtration. Technical factors: 65 kv.p., 10 ma., diameter of beam at 7 in. from target—3.5 in., inherent filtration equivalent to 0.5 mm. of aluminum

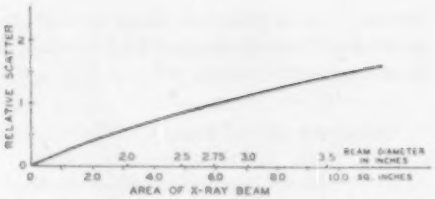

Fig. 10 • Relative amount of radiation scattered from human skull (which had been filled and coated with wax) as function of area of roentgen-ray beam. Technical factors: 65 kv.p., 10 ma., inherent filtration equivalent to 0.5 mm. of aluminum

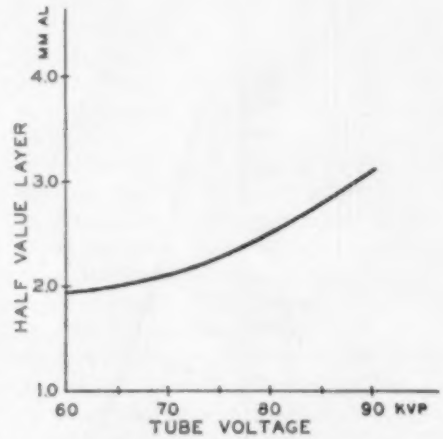

Fig. 11 • Effect of tube voltage on quality (HVL) of radiation generated. Technical factors: 10 ma., total filtration equivalent to 2.25 of aluminum

dental roentgenography, merely placed the ionization chamber against the skin of the patient's face. He found that a complete roentgenographic examination of the mouth, consisting of 14 films with an average time of exposure of approximately 3 seconds each, exposed the skin in the area of the maxillary bicuspids to between 55.9 and 91.6 r, with the average of 76.9 r. This region was found to be the one most heavily exposed during a complete roentgenographic examination of the mouth. Budowsky used a conventional dental x-ray machine operated with 65 kilovolts peak, 10 milliamperes, short cone, 0.5 mm. of aluminum equivalent internal filtration, and no lead diaphragm. The diameter of the roentgen-ray beam used was 4⅛ inches when measured 8 inches from the focal spot of the x-ray tube.

With identical equipment and conditions, Budowsky's experiment was repeated with the wax phantom. At the simulated skin over the right maxillary bicuspid, 61.0 r were recorded. It was

determined that the machine delivered radiation at the rate of 3.2 r per second (measured in air) at the tip of the cone. With the machine operating for a total of 41 seconds to expose the 14 films, a total air-dose of 131.2 r was delivered to the face of the wax phantom.

The experiment was repeated next with another x-ray machine functioning first with 65 kilovolts peak and then with 90 kilovolts peak. The machine was operated with 10 milliamperes, short cone, total filtration equivalent to 2.25 mm. of aluminum, and with the diameter of the beam limited to 2¾ in. when measured 7 in. from the target of the x-ray tube. At the simulated skin over the area of the maxillary bicuspids, 6.50 r were recorded when 65 kilovolts peak was used, and 5.10 r when 90 kilovolts peak was used. The use of the higher voltage caused the skin-dose to be reduced 21.5 per cent. Table 3 lists the times of exposure that were used and the amount of radiation that each exposure of the mouth contributed to the exposure of the skin over the right maxillary bicuspid region. The exposures employed at 90 kilovolts peak were determined by applying the conversion factor of 0.36 (from Figure 5) to the times of exposure used with 65 kilovolts peak.

The reduction of the skin-dose of the most heavily exposed area of the face from 61.0 r to 6.50 r (89 per cent reduction with 65 kilovolts peak) through the use of the additional filtration, smaller diameter beam and faster film, indicates the value of these changes in technic. The additional filtration also reduced the output of the machine to 0.85 per second. The sum of the times of exposure that were used in this improved technic was 28 seconds. The product of 0.85 and 28 signified that the face of the patient was exposed to only 23.8 r (measured in air) during the roentgenographic examination of the entire mouth with 14 exposures instead of the previous exposure of 131.2 r. In this way, an 82 per cent re-

Table 3 • Times of exposure used and amount of radiation each exposure of mouth contributed to exposure of skin over right maxillary bicuspid region

Region exposed	65 kv.p.		90 kv.p.	
	Time of exposure (seconds)	Exposure reaching skin in area of right max. bicuspid	Time of exposure (seconds)	Exposure reaching skin in area of right max. bicuspid
Max. central incisors	2.25	0.10 r	0.81	0.20 r
Max. left lateral incisor & cuspid	2.00	*	0.72	*
Max. left bicuspids	2.00	0.15 r	0.72	0.15 r
Max. left molars	2.50	0.10 r	0.90	0.10 r
Max. right lateral incisor & cuspid	2.00	1.95 r	0.72	1.45 r
Max. right bicuspids	2.00	1.95 r	0.72	1.45 r
Max. right molars	2.50	1.85 r	0.90	1.25 r
Mand. central incisors	1.75	*	0.63	*
Mand. left lateral incisor & cuspid	1.75	*	0.63	*
Mand. left bicuspids	1.75	*	0.63	*
Mand. left molars	2.00	*	0.72	*
Mand. right lateral incisor & cuspid	1.75	*	0.63	*
Mand. right bicuspids	1.75	*	0.63	*
Mand. right molars	2.00	*	0.72	*
Totals	28.00 sec.	6.50 r	10.08 sec.	5.10 r
Average	2.00 sec.		0.72 sec.	

*Indicates readings less than 0.10 r.

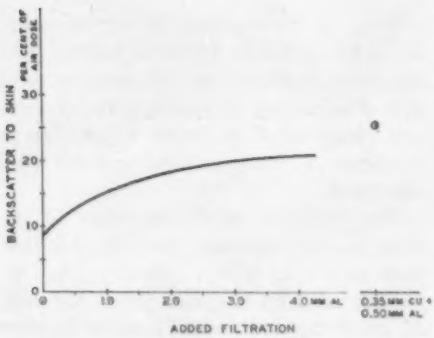

Fig. 12 • Radiation scattered back to skin from underlying tissue as function of added or external filtration. Technical factors: 65 kv.p., 10 ma., target-skin distance—7.25 in., diameter of beam at distance of 7.0 in. from target—3.5 in., inherent filtration equivalent to 0.5 mm. of aluminum

duction in the exposure of the entire face has been accomplished. Backscattered radiation has been included in the measurements of the exposure of the skin in the region of the right maxillary bicuspids, but it has been ignored in the calculations regarding the total air-doses to the entire face.

Other experiments were performed to learn the effect of added filtration and size of the roentgen-ray beam on the skin-dose. With an ionization chamber located at the tip of the pointed cone, the output of roentgens of an x-ray machine was measured with various amounts of filtration placed in the path of the primary beam. Next, these measurements were repeated with the ionization chamber located in the same position as before, but with it half immersed in a large tub of water. The surface of the water, located at the axis of the chamber, simulated the skin of the patient while the deeper layers of water acted as the underlying tissues which contribute to the raidation that is scattered back to the surface or skin.

Water was used as the phantom material because it closely resembles the density and effective atomic number of human tissue. The curve in Figure 12 illustrates how the amount of scattered radiation increases with increased filtration. With no added filtration, an air-dose of 100 r directed to the skin, resulted in a skin-dose of 108.5 r. The extra 8.5 r or 8.5 per cent were contributed by the radiation scattered back to the skin from the underlying tissues. As additional aluminum filters were placed in the path of the roentgen-ray beam, the skin-dose per 100 r of air-dose increased, but at an ever diminishing rate. With 3.0 mm. of added aluminum filtration, the backscatter was 20 per cent. With a filter composed of 0.35 mm. of copper plus 0.50 mm. of aluminum, the amount of the backscatter was slightly more than 25 per cent.

The amount that the air-dose or output of the x-ray machine (Fig. 6) decreased with increased filtration more than compensated, however, for the increased backscatter (Fig. 12), even though the time of exposure must be increased when filtration is added.

Figure 13 illustrates the small change in backscatter that occurred when the circular area of exposed skin was reduced from 9.62 sq. in. (3.5 in. in diameter) to 5.94 sq. in. (2.75 in. in diameter) through the use of lead diaphragms with apertures of suitable size in them. Therefore, the main value of the lead diaphragm in dental roentgenography is not to reduce the backscatter that reaches the skin, but

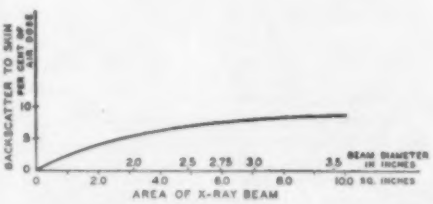

Fig. 13 • Radiation scattered back to skin from underlying tissue as function of area of roentgen-ray beam. Technical factors: 65 kv.p., 10 ma., target-skin distance—7.25 in., total filtration equivalent to 0.5 mm. of aluminum

to limit the area of skin exposed to the primary roentgen-ray beam. Reducing the diameter of the exposed area of skin from 3.5 to 2.75 in. reduced the exposure from backscatter from 8.5 to 7.5 per cent, whereas the area of skin exposed by the air-dose decreased from 9.62 to 5.94 sq. in., or approximately a 38 per cent reduction.

It was determined experimentally with the wax phantom that when identical air-doses were delivered at 7.5 and 15 inch target-skin distances to a constant area of skin, the amount of backscatter remained constant. The backscatter was measured at a perpendicular distance of 40 inches from the central ray of the primary roentgen-ray beam. It also was determined that less scattered radiation was produced when properly diaphragmed open-end cones were used than when pointed plastic cones were used.

DEPTH-DOSE

Measurements of the depth-dose were made in water to determine the approximate amounts of radiation present along the path of the central ray at various depths within the patient. These measurements involved using an ionization chamber to determine initially the air-dose and the skin-dose, and then finally the depth-dose with the ionization chamber submerged to known depths in a large tub of water. Two series of measurements were made with 65 kilovolts peak with different filters and sizes of beams and two were made with constant filtration and size of beam but with 65 and 90 kilovolts peak. In Figure 14, curves are presented which show the number of roentgens measured at various depths per 100 roentgens in air (percentage of air-dose). These curves indicate that both

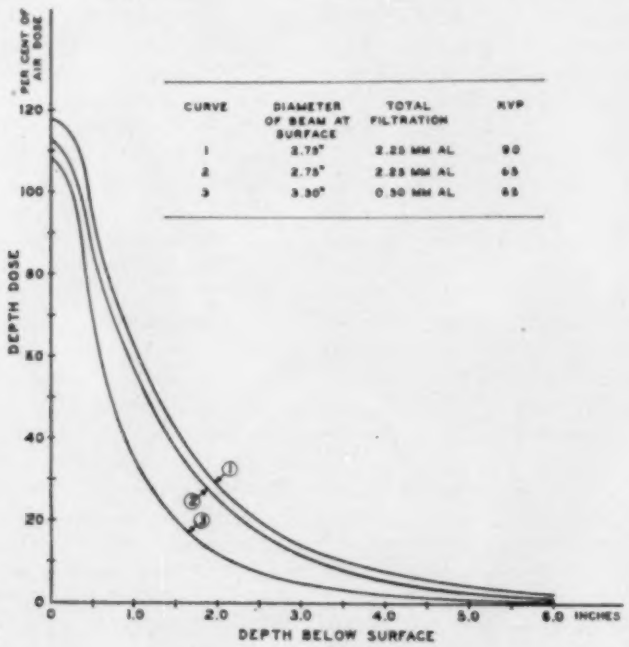

Fig. 14 • Depth dose, or amount of radiation found at given depth below the skin expressed as percentage of air-dose delivered to the skin. Technical factors: 10 ma., target-skin distance—7.25 in.

the skin-dose and the depth-dose are increased with added filtration and higher voltage.

One inch of water or soft tissue attenuated 65 per cent of the air-dose when unfiltered radiation, generated with 65 kilovolts peak was tested. With 2.25 mm. of aluminum of total filtration in the beam, the percentage of the air-dose attenuated by one inch of tissue was 44 per cent and 38 per cent for radiation generated with 65 kilovolts peak and 90 kilovolts peak respectively.

GONAD DOSE

The amount of radiation that reaches the human gonads is important because of the genetic implications of such exposure. An ionization chamber with a range from 0 to 1 mr was used to measure the radiation present in the region of the male gonads. The ionization chamber was cylindrical, 4.5 in. long and 4.5 in. in diameter. The subjects were seated on a conventional dental chair while roentgenograms were made of their teeth. The ionization chamber was positioned on the seat of the chair between the patient's thighs and held tightly against the pelvic region. The small aluminum stem of the ionization chamber extended upward during these tests. A check was made to determine whether the readings would vary if the stem were vertical or horizontal. No change in the measurements was noted from this variation. After each dental film-packet was exposed, the chamber was read and recharged for the next exposure.

Since the gonads do not lie within the path of the primary roentgen-ray beam during a dental roentgenographic survey, the only exposure of the region must come either from radiation scattered from the head of the patient through his body or through the air, or from radiation leaking from the head of the x-ray machine. These possibilities were investigated next. To measure only the amount of radiation scatter through the trunk of the patient that would reach his gonads required that a sheet of leaded rubber be placed across the lap of the patient to exclude all exposure from scattering in the air. No radiation was found to scatter through the body of the patient. This observation is reasonable, because the more than 24 inches of soft tissue that separates the gonads from the occlusal plane of the mouth presents a very formidable barrier to the passage of any roentgen rays generated with low voltage.

To test for exposure of the gonads from leakage radiation, a thick lead diaphragm with no aperture was placed over the portal through which the primary beam emerges. This device prevented exposure of the head of the patient. The usual times of exposure were used and the dose to the gonads was measured. No measurable amount of leakage radiation was detected at the gonads with the brief periods of exposure that are used with dental patients.

The distance between the seat of the chair and the occlusal plane of the patient was measured for each subject as an indication of the length of his torso.

Measurements were made on 39 adult men of the amounts of radiation reaching the gonad region from each exposure in a 14 film roentgenographic examination of the complete mouth. The conventional x-ray machine used in this study was operated at 65 kilovolts peak and 90 kilovolts peak with 10 milliamperes. The diameter of the beam was 3⅛ in. when measured 8 in. from the focal spot of the x-ray tube or 1 in. beyond the end of the short pointed cone. The machine contained filtration equivalent to 2.25 mm. of aluminum. The synchronous motor timer had been carefully calibrated. The values for voltage and current were controlled carefully to avoid variations in these factors during all of these tests.

To compare the exposure of the gonadal region from a complete oral roentgenographic examination of 14 exposures made with 65 kilovolts peak with the

Table 4 • Comparison of exposure of gonadal region from complete oral roentgenographic examination made at 65 kv. p. with that made at 90 kv. p.

Region	Vertical angulation	Time of exposure with 65 kv.p. (seconds)	Average of gonadal air-dose with 65 kv.p.	Time of exposure with 90 kv.p. (seconds)	Average of gonadal air-dose with 90 kv.p.	Reduction in gonadal air-dose with 90 kv.p. (%)
Maxillary central incisors	+45°	2.25	0.366 mr	0.81	0.326 mr	10.9
Maxillary cuspid	+45°	2.00	0.334 mr	0.72	0.295 mr	11.7
Maxillary bicuspids	+35°	2.00	0.338 mr	0.72	0.296 mr	12.4
Maxillary molars	+30°	2.50	0.380 mr	0.90	0.338 mr	11.1
Mandibular central incisors	−15°	1.75	0.265 mr	0.63	0.222 mr	16.2
Mandibular cuspid	−20°	1.75	0.243 mr	0.63	0.215 mr	11.5
Mandibular bicuspids	−10°	1.75	0.268 mr	0.63	0.231 mr	13.8
Mandibular molars	0°	2.00	0.264 mr	0.72	0.237 mr	10.2
Totals		28.00	4.285 mr	10.08	3.772 mr	12.0

Total filtration equivalent to 2.25 mm. aluminum.
Beam diameter at 7 in. from target:—2.75 in.
Tube current: 10 ma. Film: Radle-Tized.
Target-skin distance:—7 in.

same examination, made of the same patient, but with 90 kilovolts peak, a definite procedure was followed. The times of exposure made with 90 kilovolts peak were 36.0 per cent as long as the times of exposure made with 65 kilovolts peak (conversion factor = 0.36. Fig. 5). Roentgenograms were made of the central regions, each twice, once with 65 kilovolts peak and once with 90 kilovolts peak. Roentgenograms were then made of the remaining regions, first on one side of the patient with 65 kilovolts peak and then on the other side with 90 kilovolts peak. The contribution to the exposure of the gonads was measured for each region. To arrive at the total gonadal exposure from a 14-film examination made with 65 kilovolts peak required that the contributions from the two central regions be added to double the contributions from the other six films that were exposed with 65 kilovolts peak in order to obtain the contribution of 14 films. The same procedure was used to find the gonadal exposure resulting from the examination with 90 kilovolts peak. The results of these numerous measurements are averaged in Table 4.

The averaged gonadal doses listed in Table 4 were not the doses absorbed by the gonadal tissue at the center of the testicles, but only air-doses. However, an approximate factor was determined experimentally for converting the air-dose to the dose absorbed by gonadal tissue. It was assumed for the adult man that the average thickness of a testicle was 1½ inches. Since it was not possible to insert the large 1.0 mr ionization chamber into the center of such a small organ, an indirect method was chosen.

It appears obvious that the radiation scattered to the region of the gonads will be less penetrating than the primary beam. Therefore if, for the primary beam, a factor is found for converting air-doses to the actual doses received by tissue, this factor would be conservative when applied to air-doses of the less penetrating scattered radiation. This factor was found to be approximately 50 per cent and was determined with the machine that was used in the tests with the male subjects. The factor is the depth-dose (expressed as a percentage of the air-dose) that was measured ¾ inch below the surface of a large tub of water the surface of which was 26 inches from the focal spot of the x-ray tube. A distance of 26 inches was chosen for this test because the distance between the gonads and the occlusal plane for the average subject was about 26 inches.

When the conversion factor, 0.5, is applied to the measurements of the total air-dose listed in Table 4, the doses absorbed by tissue that are effective at the center of the testicles become 2.14 mr and 1.88 mr for complete oral roentgenographic examinations (14 films) made with 65 kilovolts peak and 90 kilovolts peak respectively.

It also is possible to calculate the percentage of reduction in facial and gonadal doses when changing from 65 kilovolts peak to 90 kilovolts peak (Table 5). These calculated values are reasonably similar to the values determined experimentally. The figures used in this illustration appear earlier in this paper.

Examinations by posterior bitewing roentgenograms were made of 25 adult men (18 years and over) and 9 boys who ranged from 3 to 12 years of age. The roentgenograms of the adults were made with 65 kilovolts peak on one side and 90 kilovolts peak on the other. The lengths of exposure with Radia-Tized film were 2.5 and 0.9 seconds for the 65 and 90 kilovolts peak technics respectively. The vertical angulation was 8 degrees downward, and all of the other technical factors were the same as were used in the periapical examinations previously discussed. Experience has indicated that the following factors, 0.65, 0.75, and 0.9, should be used to convert the time of exposure for the adult's posterior bitewing to times of exposure appropriate for children aged 3, 5, and 12 years respectively. The children in this series of tests were exposed only with 65 kilovolts peak.

The adult's examination by the bitewing technic resulted in an averaged air-dose at the region of the male gonads of 0.344 mr per film and 0.304 mr per film for 65 and 90 kilovolts peak technics respectively. The dose absorbed by tissue that is effective at the center of the testicle would be one half of the air-dose. The use of the 90 kilovolts peak technic resulted in a decrease of 11.8 per cent in the exposure of the male gonads.

With a group of nine male children, ranging from 3 to 12 years of age, measurements were made of the air-dose found in the region of the gonads from various periapical and lateral-jaw examinations. Lateral-jaw examinations also were performed on seven adults and similar measurements made with them.

In addition to measuring the contribution of each dental exposure to the gonadal dose of the child or adult, measurements were made of the distance from the seat of the dental chair to the occlusal plane of the seated patient. These latter measurements provided an approximation of the distance that the secondary or scattered radiation from the face traveled to reach the gonads.

To illustrate how the rate for the gonadal dose varies as a function of the

Table 5 • Percentage of reduction in facial and gonadal doses achieved by changing from 65 kv.p. to 90 kv.p.

	65 kv.p. (A)	90 kv.p. (B)	Calculated reduction in dose $\frac{(A-B)}{(A)}$ 100	Measured reduction in dose
(1) Relative times of exposure	1.	0.36	—	—
(2) Relative roentgen output r per second	1.	2.	—	—
(3) Relative facial doses (1x2)	1.	0.72	28.%	21.5%
(4) Relative rates of radiation scattered	1.	2.4	—	—
(5) Relative amounts of scattered radiation reaching gonads (1x4)	1.	0.864	13.6%	12.0%

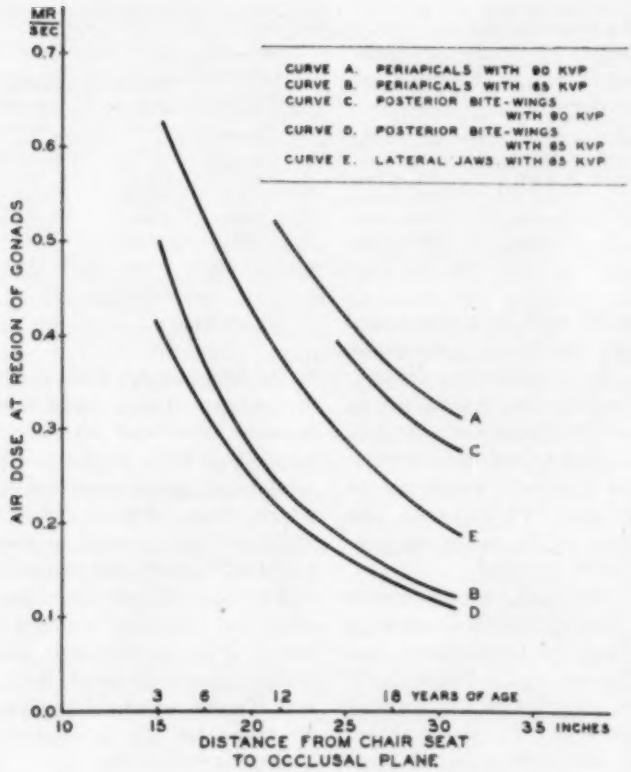

Fig. 15 • Gonadal doses (measured in air) for various technics as functions of length of patient's torso. Technical factors: 10 ma., target-skin distance—7.0 in., diameter of roentgen-ray beam at distance of 7.0 in. from target—2.75 in.

length of the torso, the rate for the air-dose at the region of the gonads for each examination has been expressed as milli-roentgens per second and is plotted in Figure 15 against length of the torso. These data indicate that the rate of exposure of the gonads falls rapidly with increasing length of the torso. Because of their shorter bodies, children receive radiation in the region of the gonads at a greater rate from a given exposure of the face than does a taller adult who is similarly exposed. Part of the effect of the higher rate of gonadal exposure of the child is cancelled by the shorter time of exposure that is indicated by the child's thinner structures, but the two factors do not entirely cancel each other. The effect of these two factors on the gonadal exposure of the child are illustrated in Table 6, in which values for the rates of gonadal dose taken from Curve D in Figure 15 are used.

This example indicates, although a three year old child has a relative rate for gonadal dose 2¾ times that of an adult, his relative gonadal dose is only 1¾ times that of an adult because of the shorter exposure time used for children of this size.

To test the theoretical reductions in gonadal doses by making various changes

Table 6 • Effect of higher rate of gonadal exposure of child and shorter time of exposure. Rates of gonadal dose taken from Curve D in Figure 15

Age	Gonadal air-dose rate	Relative gonadal air-dose rate	Relative times of exposure	Relative gonadal doses
(Adult) 18 years	0.14 mr/sec.	1.00	1.00	1.00
12 years	0.22 mr/sec.	1.57	0.90	1.41
6 years	0.31 mr/sec.	2.21	0.75	1.66
3 years	0.38 mr/sec.	2.72	0.65	1.77

in technic, special tests were performed with adult men. With two individuals, measurements were made to discover whether reducing the time of exposure by 20 per cent and prolonging the time of development in high-energy developer at 68°F. from 3 to 5 minutes would reduce also the gonadal dose by 20 per cent. The average reduction in the measured gonadal dose was 18.25 per cent.

With four individuals, measurements were made to discover whether switching from Radia-Tized to Ultra-Speed film and reducing the times of exposure by 79 per cent would reduce also the gonadal dose by 79 per cent. The average reduction in the measured gonadal doses was 80.9 per cent.

With one individual, measurements were made to determine whether changing from a lead diaphragm that allowed 9.62 sq. in. of the patient's face to be irradiated to another diaphragm that allowed 3.14 sq. in. to be irradiated, or a 67.4 per cent reduction of the area exposed, would reduce the gonadal dose by the same per cent. The reduction in the measured gonadal dose was found to be 64.7 per cent.

With five individuals, measurements were made to determine whether changing from a cone which provided a 7½ in. target-skin distance to another which provided a 15 in. distance, and also increasing the times of exposure fourfold, would have any change on the gonadal dose. There was no change in gonadal dose within the limits of the experimental errors associated with this type of study.

DISCUSSION

Every day, people's bodies receive 0.4 mr of exposure from cosmic rays from the heavens above and from the radioactive minerals in their bodies and in their environment. In the course of 30 years, exposure from these natural sources of radiation will amount to approximately 4,300 mr. In this same period of time, they will receive 100 mr from the testing of atom and hydrogen bombs if the present rate of firings is continued. This exposure of 100 mr per 30 years, the government says, is a very small amount and should be no cause for alarm insofar as genetic damage is concerned.

From this present study, it has been determined that a complete oral roentgenographic examination consisting of 14 films, exposes the gonads of the adult man to an absorbed-tissue dose of 2.14 mr when the following technical factors are used:

65 kilovolts peak
10 milliamperes
Total time of exposure—28 seconds
Short cone—7 in. target-skin distance
Diameter of beam at tip of cone—2.75 in.
Total equivalent filtration—2.25 mm. aluminum

These data indicate that 46 complete roentgenographic examinations of an adult man would expose his reproductive cells to about 100 mr, the same negligible amount that he will receive from testing of bombs in 30 years. It should be noted that women receive even less irradiation of the reproductive cells than do men.

During the complete oral roentgenographic examination, the most heavily exposed area of skin, which is over the region of the maxillary bicuspids, received a skin-dose of only 6.5 r, whereas 23.8 r (measured in air) was the sum of all of the radiation used to expose the 14 films. Of the 23.8 r delivered to the face, only 0.00214 r effectively reached the male gonads. Therefore, approximately 1/10,000 of the roentgen-ray radiation directed to the face during the dental examination ever reached the reproductive organs. Only that radiation which reaches these organs is genetically important.

Draping a sheet of leaded rubber over the pelvic region of a patient is entirely unnecessary if the dental roentgenographic examination is made under the conditions previously outlined. The leaded rubber apron would merely call attention to a negligible hazard.

The use of higher-speed films will reduce greatly the exposure of the patient. High-speed film usually can be used with older x-ray machines equipped with mechanical timers by operating with 2.5 milliamperes instead of the usual 10 milliamperes. This change quadruples the times of exposure to a length of time that can be measured accurately with existing timers. The use of Ultra-Speed film will reduce the absorbed dose of gonadal tissue from the complete examination of the mouth to 0.45 mr, almost the same amount that people receive each day of their lives from natural sources of radiation. Certainly the benefits of such judicious use of roentgen-ray radiation in dentistry far outweigh any possible hazard incurred.

The use of high-speed film with the child is desirable from the standpoint of minimizing his exposure and also minimizing the possibility of movement during the exposure.

In Table 7 are listed various changes in technic according to their recommended order of adoption. In this evaluation such factors as time of exposure, reduction in the facial and gonadal doses, cost of the

Table 7 • Changes in technic according to recommended order of adoption

Factor to be changed	Change in time of exposure	Per cent reduction in facial dose	Calculated scattered dose reaching gonads (% reduction)	Change in roentgenographic contrast
(1) From 0 to 1.75 mm. Al. filter added	42.5% inc.	57.1	31.0	Slight decrease
(2) From 3.5 to 2.75 in. diameter x-ray beam at 7" from target	None	38.3	30.0	Slight improvement
(3) From Radia-Tized to Ultra-Speed film	79.0% red.	79.0	79.0	Slight decrease
(4) From 3 minute to 5 minute developing time at 68°F. with high energy developer	20.0% red.	20.0	20.0	None
(5) From 65 kv.p. to 90 kv.p.	64.0% red.	28.0	13.6	Slight decrease
(6) From 0 to 0.35 mm. cu. + 0.50 mm. Al. added filter	510% inc.	83.7	56.0	Great decrease
(7) From 7.5 in. to 15 in. target-skin distance	400% inc.	Same	Same	Same

change, and quality of the roentgenograms produced have been taken into consideration.

SUMMARY

The effect that each of several technical factors had on the doses of roentgen-ray radiation that reached the dental patient while he was being examined roentgenographically were studied. Under certain conditions, it was found that a complete roentgenographic examination of the jaws of the adult patient resulted in 23.8 r (measured in air) being administered to the face and approximately 1/10,000 of that amount, or 2.14 mr, effectively reaching the male gonads. The length of the patient's torso was found to influence greatly the gonadal dose received. The relative gonadal dose for the three year old child was found to be 1¾ times as much as was received by the adult. Various changes in technic are recommended to reduce further the amount of radiation that reaches the dental patient.

Use of a sodium dehydroacetate-sodium oxalate dentifrice in the control of dental caries

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If the decalcification of the tooth during the carious process is due to the acids formed by an enzymic degradation of carbohydrate from ingested food,[1] then it should be possible to prevent dental caries by preventing acid formation on the tooth surface. Actually, every successful method for the control of dental caries,[2-6] with the exception of the use of fluorides,[7] has in one way or another prevented the formation of acids.

From the theoretical aspects of the problem, it would seem logical that, if the acids are formed by the action of enzymes, substances that would inhibit the action of these enzymes should be useful in the control of dental caries. Until recently, this method of approach has been unsuccessful. There are literally hundreds of compounds that will inhibit the glycolytic enzymes but that seem to have no effect on acid formation *in situ* on the tooth surface within a relatively short time after their application.

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In 1952, it was suggested that the prime difficulty associated with the use of enzyme inhibitors for the prevention of dental caries is the rapidity with which substances are cleared from the mouth. In order for the inhibitor to be effective it must be at the site of acid formation at the time sugar is present. Methods of accomplishing the retention of inhibitors of acids in the mouth are difficult to devise. In 1952 a method based on the absorption of compounds by the dental plaque was suggested, and a number of compounds were found that adhered to the dental plaque for long periods of time.[8] Such compounds as penicillin, chlortetracycline (Aureomycin), sodium N-lauroyl sarcosinate, sodium dehydroacetate and a few peptides with low molecular weights were found that exhibited this property.

It was thought that an ideal preparation for the prevention of dental caries might be one that not only would decrease the rate at which acids are formed from carbohydrate but would make the tooth more resistant to acids, so that the presence of a higher acid potential would be necessary for the attack on the tooth. Among the compounds which have the latter property are fluorides,[9, 10] lead salts and oxalates.[11] This paper is concerned with the effect on dental caries of the use in a dentifrice of a combination of sodium dehydroacetate and sodium oxalate.

Preliminary experiments indicated that sodium dehydroacetate would attach itself to the microbial plaque on the tooth surface and to the epithelial tissue of the mouth and persist *in situ*.[8] The presence of sodium dehydroacetate could be detected for 48 hours, and the effectiveness in preventing acid formation on the tooth surface persisted for from 12 to 24 hours. The test procedures did not go unchallenged. Forscher and Hess[12] did not confirm these tests, but Brudevold and coworkers[13] and Hein[14] partially confirmed them.

Since the concept of absorption by dental plaque was first proposed, caries studies on animals have been performed with penicillin, bacitracin, oxytetracycline (Terramycin) and sodium N-lauroyl sarcosinate.[15-17] All of these compounds were shown to be effective in reducing caries activity in rats or hamsters.

Clinical experiments have been performed with penicillin and sodium N-lauroyl sarcosinate. The clinical results with penicillin were variable.[5, 18] Zander[5] found that penicillin when used morning and night in a tooth powder was effective in reducing caries activity. Hill and co-workers[18] failed to confirm these results. In one experiment at four installations, sodium N-lauroyl sarcosinate was found to be effective in reducing caries activity in humans,[19] but as yet no dupli-

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cate experiments have been reported, although one is in progress.

EXPERIMENT

Organization and Procedure • The experiment was designed so that the results from morning and night use of the test dentifrice could be compared with those (1) from the morning and night use of a placebo dentifrice, (2) from the habitual procedures of a similar group of persons using the dentifrice of their choice, and (3) from after-meal use of the test dentifrice. The experiment was organized along lines similar to those of a previous experiment in which after-meal brushing with a neutral dentifrice was studied.[4]

Young adults from the general offices of the Illinois Bell Telephone Company in Chicago were used as subjects. One of us (G.F.S.) was responsible for the conduct of the experiment and made all of the clinical examinations and one of the series of roentgenographic examinations. The personnel department of the company used their facilities in securing subjects for the test. All of the persons under 34 years of age who were interested in being subjects were taken. Only those who had 30 or more caries-free surfaces, however, were used in the study.

The individuals were divided into three general groups, the group placement depending in part on the preference of the individual. Those who did not wish to follow any prescribed routine were used as random controls. Those who would conscientiously brush after meals were used in the test group following this routine. The other subjects were placed at random either in the group which used a placebo dentifrice or in the group using the test dentifrice morning and night. The subjects did not know whether they were using the test dentifrice or the placebo dentifrice.

The groups were designated as follows:

Group T-1-D. The subjects were given complete instructions concerning the proper technic of brushing the teeth, and they were issued an adequate supply of dentifrice and toothbrushes as needed. The active ingredients in the test dentifrice were 0.75 per cent sodium dehydroacetate and 0.5 per cent sodium oxalate. They were instructed to brush their teeth on arising in the morning and before retiring in the evening.

Group T-2-D. The members of this group used the same test dentifrice within ten minutes after each meal. They were given identical instructions concerning the proper technic of brushing the teeth and an adequate supply of dentifrice and toothbrushes as needed.

Group C. The members of this first control group continued the oral hygiene technic to which they were accustomed. They were given no instructions concerning the proper method of brushing the teeth, but they were issued brushes as needed. Each person reported the brand of dentifrice preferred and the frequency of brushing.

Group C-1-D. The members of this second control group used a placebo dentifrice with the same composition as the test dentifrice except that the sodium dehydroacetate and sodium oxalate were omitted from the formula. They were given complete instructions concerning the proper technic of brushing the teeth, and they were issued an adequate supply of dentifrice and toothbrushes as needed. They were instructed to brush their teeth immediately on arising and before retiring.

The clinical examinations were done with sharp explorers, compressed air and adequate light, as in a previous experiment.[4] All results of examinations were tape recorded by the examiner (G.F.S.) and subsequently were transcribed on a permanent card by a dental hygienist. Complete crown-view roentgenograms, which had been taken approximately one week earlier, were available at the time of the examination.[4]

The record cards had space for three

annual examinations and clearly showed the condition of each tooth surface except the third molars, which were not included in the experiment. The records of the results of the roentgenographic examinations were kept independent of the clinical examinations. Two different readings of the roentgenograms were made by two different individuals and were entered on separate cards, neither examiner having access to the results of the other. The results were then correlated by a third examiner, and any discrepancies were settled by discussion with one of the original examiners.

Similarity of Groups • Except for the subjects in Groups C and T-2-D, who were assigned on the basis of personal preference, the subjects were distributed at random. At the start of the experiment no attempt was made to determine the homogeneity of each group. Insofar as a 35 to 40 per cent loss of subjects was expected in each group (based on the turnover statistics at the company), it was thought that such an analysis would not be useful until the completion of the experiment. After the subjects had completed one year and two years of the test, the homogeneity was determined. Comparisons were made in respect to age; DMF surfaces; caries-free surfaces; DF proximal, occlusal and labial, lingual and buccal surfaces; caries-free proximal, occlusal and labial, lingual and buccal surfaces; DF and missing teeth; and caries-free teeth. The results of these comparisons are shown in Table 1. In general, the groups were remarkably similar in regard to all of these variables and in regard to mean values and ranges.

Number of Subjects • The initial examinations were made on 2,300 subjects, but at the end of the first year 1,294 subjects remained, and at the end of two years 967 completed the experiment. This loss was more than was expected for the first year, but that at the end of the second year was less than was expected.

Starred Surfaces • During the examinations at the end of the first and second years, a number of proximal-occlusal fillings were found where the previous examination revealed only a proximal cavity. It was obvious that in most instances these occlusal surfaces were filled, not because of an occlusal cavity, but because of the usual practice of extending the cavity for retention. These surfaces were indicated by a star but still were considered new carious lesions. The results were compiled both with and without the starred surfaces.

RESULTS

The results of the experiment were recorded and subjected to statistical analysis (Tables 2, 3, 4 and 5). It was found that there was no statistically significant difference between the annual increments in the two control groups (Groups C and C-1-D) and the two test groups (Groups T-1-D and T-2-D), although in every instance there was a statistically significant difference between either test group as compared with either control group or when the two control groups and the two test groups were compared in combination. The results were surprisingly consistent.

During the first year, the reduction in the incidence of caries as shown by clinical examinations was between 35 and 43 per cent when all of the surfaces, including the starred ones, were used in the compilations. On the basis of roentgenographic analysis only, the reduction varied from 49 to 59 per cent. If new DF teeth were taken as the criterion, the reduction varied from 47 to 59 per cent, depending on the groups compared.

During the second year, the clinical examinations indicated a slightly greater reduction, varying from 40 to 63 per cent, and the roentgenographic examinations showed a reduction varying from 40 to 53 per cent. During the second year, if new DF teeth were used as the criterion,

Table 1 • Distribution data on subjects at end of first and second years of experiment arranged according to groups

	C	C-1-D	C + C-1-D	T-1-D	T-2-D	T-1-D + T-2-D
No. of subjects						
1st yr.	135	307	442	483	369	852
2nd yr.	96	223	319	370	278	648
Age						
1st yr.	22.2	23.4	23.0	24.6	24.7	24.6
2nd yr.	22.3	23.8	23.3	25.2	25.3	25.2
DMF surfaces						
1st yr.	44.7	49.2	47.9	47.9	47.7	47.8
2nd yr.	46.9	49.8	48.9	48.1	48.0	48.1
Caries-free surfaces						
1st yr.	90.9	85.8	87.3	86.9	87.0	86.9
2nd yr.	88.1	85.0	85.9	86.7	86.8	86.7
Proximal surfaces						
1st yr.: Decayed	14.5	14.9	14.8	13.8	13.0	13.4
Filled	9.8	11.5	11.0	11.5	12.0	11.7
DF	24.3	26.4	25.8	25.3	25.0	25.1
2nd yr.: Decayed	14.6	15.1	15.0	13.7	13.1	13.4
Filled	10.5	11.3	11.1	11.7	12.1	11.9
DF	26.1	26.4	26.1	25.4	25.2	25.3
Occlusal surfaces						
1st yr.: Decayed	0.7	0.7	0.7	0.5	0.5	0.5
Filled	9.1	9.5	9.4	9.4	9.3	9.4
DF	9.8	10.2	10.1	9.9	9.8	9.9
2nd yr.: Decayed	0.6	0.6	0.6	0.5	0.6	0.5
Filled	9.4	9.5	9.5	9.5	9.5	9.5
DF	10.0	10.1	10.1	10.0	10.1	10.0
Labial-lingual-buccal surfaces						
1st yr.: Decayed	0.9	1.2	1.1	1.0	0.9	0.9
Filled	3.4	4.2	4.0	4.0	4.0	4.0
DF	4.3	5.4	5.1	5.0	4.9	4.9
2nd yr.: Decayed	0.9	1.2	1.1	1.0	0.9	0.9
Filled	3.4	4.2	4.0	4.0	4.0	4.0
DF	4.3	5.4	5.1	5.0	4.9	4.9
Caries-free proximal surfaces						
1st yr.	27.3	24.6	25.4	25.5	25.7	25.6
2nd yr.	25.9	24.3	24.8	25.4	25.6	25.5
Caries-free occlusal surfaces						
1st yr.	16.0	15.3	15.5	15.5	15.4	15.4
2nd yr.	15.5	15.2	15.3	15.5	15.3	15.4
Caries-free labial-lingual-buccal surfaces						
1st yr.	47.6	45.8	46.4	45.9	45.9	45.9
2nd yr.	46.7	45.4	45.8	45.9	45.8	45.9
DF teeth						
1st yr.	17.2	18.3	17.9	17.5	17.4	17.5
2nd yr.	17.7	18.3	18.1	17.6	17.4	17.5
Missing teeth						
1st yr.	2.2	2.5	2.4	2.6	2.7	2.6
2nd yr.	2.5	2.6	2.6	2.6	2.6	2.6
Caries-free teeth						
1st yr.	8.6	7.2	7.6	7.8	8.0	7.9
2nd yr.	7.8	7.1	7.3	7.9	8.0	7.9

Table 2 • New caries activity during first year of experiment, found by clinical and roentgenographic examinations (including starred surfaces)

	C vs. T-1-D	C-1-D vs. T-1-D	C vs. T-2-D	C-1-D vs. T-2-D	C + C-1-D vs. T-1-D + T-2-D
New DF surfaces (clinical)					
Mean	0.96 0.62	1.08 0.62	0.96 0.62	1.08 0.62	1.04 0.62
Standard deviation	1.29 1.08	1.47 1.08	1.29 1.12	1.47 1.12	1.42 1.10
% reduction	35	43	35	43	40
t ratio	3.02	5.08	2.85	4.66	5.93
Probability	<0.005	<0.001	0.005	<0.001	<0.001
New proximal DF surfaces (roentgenographic)					
Mean	0.49 0.25	0.50 0.25	0.49 0.25	0.50 0.25	0.49 0.25
Standard deviation	0.88 0.60	0.82 0.60	0.88 0.61	0.82 0.61	0.84 0.60
% reduction	49	50	49	50	49
t ratio	3.66	4.90	3.44	4.52	6.04
Probability	<0.001	<0.001	<0.001	<0.001	<0.001
New DF teeth					
Mean	0.19 0.10	0.22 0.10	0.19 0.09	0.22 0.09	0.21 0.10
Standard deviation	0.48 0.31	0.51 0.31	0.48 0.31	0.51 0.31	0.50 0.31
% reduction	47	55	53	59	52
t ratio	2.58	4.02	2.64	4.14	5.12
Probability	<0.02	<0.001	<0.01	<0.001	<0.001

Table 3 • New caries activity during second year of experiment, found by clinical and roentgenographic examinations (including starred surfaces)

	C vs. T-1-D	C-1-D vs. T-1-D	C vs. T-2-D	C-1-D vs. T-2-D	C + C-1-D vs. T-1-D + T-2-D
New DF surfaces (clinical)					
Mean	0.86 0.46	1.01 0.46	0.86 0.37	1.01 0.37	0.97 0.42
Standard deviation	1.36 0.86	1.36 0.86	1.36 0.75	1.36 0.75	1.36 0.82
% reduction	47	54	57	63	57
t ratio	3.63	6.07	4.44	6.68	7.78
Probability	<0.001	<0.001	<0.001	<0.001	<0.001
New proximal DF surfaces (roentgenographic)					
Mean	0.36 0.18	0.30 0.18	0.36 0.15	0.30 0.15	0.32 0.17
Standard deviation	0.95 0.47	0.78 0.47	0.95 0.48	0.78 0.48	0.83 0.47
% reduction	50	40	53	50	47
t ratio	2.73	2.39	2.86	2.63	3.64
Probability	<0.01	<0.02	0.005	<0.01	<0.001
New DF teeth					
Mean	0.21 0.08	0.20 0.08	0.21 0.05	0.20 0.05	0.20 0.07
Standard deviation	0.50 0.28	0.45 0.28	0.50 0.26	0.45 0.26	0.47 0.27
% reduction	62	60	76	75	65
t ratio	3.38	3.97	3.88	4.47	5.61
Probability	0.001	<0.001	<0.001	<0.001	<0.001

Table 4 • New caries activity during both years of experiment, found by clinical and roentgenographic examinations (including starred surfaces)

	C vs. T-1-D	C-1-D vs. T-1-D	C vs. T-2-D	C-1-D vs. T-2-D	C + C-1-D vs. T-1-D + T-2-D
New DF surfaces (clinical)					
Mean	1.83 1.07	2.17 1.07	1.83 1.00	2.17 1.00	2.07 1.04
Standard deviation	2.04 1.51	2.02 1.51	2.04 1.51	2.02 1.51	2.03 1.51
% reduction	42	51	45	54	50
t ratio	4.10	7.57	4.26	7.45	8.89
Probability	<0.001	<0.001	<0.001	<0.001	<0.001
New proximal DF surfaces (roentgenographic)					
Mean	0.91 0.46	0.85 0.46	0.91 0.41	0.85 0.41	0.87 0.44
Standard deviation	1.38 0.87	1.20 0.87	1.38 0.88	1.20 0.88	1.25 0.88
% reduction	49	46	55	52	49
t ratio	3.87	4.54	4.03	4.72	6.12
Probability	<0.001	<0.001	<0.001	<0.001	<0.001
New DF teeth					
Mean	0.44 0.20	0.44 0.20	0.44 0.15	0.44 0.15	0.44 0.18
Standard deviation	0.71 0.43	0.75 0.43	0.71 0.45	0.75 0.45	0.74 0.44
% reduction	55	55	66	66	59
t ratio	4.21	5.00	4.61	5.34	6.91
Probability	<0.001	<0.001	<0.001	<0.001	<0.001

Table 5 • New DF surfaces, with starred surfaces omitted, found by clinical examination

	C vs. T-1-D	C-1-D vs. T-1-D	C vs. T-2-D	C-1-D vs. T-2-D	C + C-1-D vs. T-1-D + T-2-D
First year					
Mean	0.76 0.38	0.78 0.38	0.76 0.38	0.78 0.38	0.78 0.38
Standard deviation	1.14 0.73	1.19 0.73	1.14 0.81	1.19 0.81	1.17 0.77
% reduction	50	51	50	51	51
t ratio	4.56	5.87	4.08	5.22	7.24
Probability	<0.001	<0.001	<0.001	<0.001	<0.001
Second year					
Mean	0.68 0.30	0.74 0.30	0.68 0.20	0.74 0.20	0.72 0.26
Standard deviation	1.24 0.63	1.11 0.63	1.24 0.48	1.11 0.48	1.15 0.57
% reduction	56	59	71	73	64
t ratio	4.12	6.13	5.38	7.35	8.37
Probability	<0.001	<0.001	<0.001	<0.001	<0.001
Total for both years					
Mean	1.43 0.72	1.60 0.72	1.43 0.59	1.60 0.59	1.55 0.66
Standard deviation	1.88 1.11	1.69 1.11	1.88 1.07	1.69 1.07	1.75 1.10
% reduction	50	55	59	63	57
t ratio	4.76	7.68	5.35	8.15	9.63
Probability	<0.001	<0.001	<0.001	<0.001	<0.001

the reduction in caries activity was from 60 to 76 per cent.

If the starred surfaces were omitted, however, the reduction in the incidence of caries the first year as shown by the clinical examinations varied from 50 to 51 per cent; the second year the variation was from 56 to 73 per cent; and the variation in the reduction during both years, which is presumably more indicative of the results, was from 50 to 63 per cent. Brushing three times a day seemed to be slightly better than brushing twice a day. When the two-year results were used, the probability was less than 0.001 in all instances.

SUMMARY

A two-year clinical experiment was conducted in which a dentifrice containing 0.75 per cent sodium dehydroacetate and 0.5 per cent sodium oxalate was used. The statistically significant results indicate that the test subjects had an annual increment of new carious lesions that was about one half that of the control subjects.

Effects of peroxide, amine and hydroquinone in varying concentrations on the polymerization rate of polymethyl methacrylate slurries

E. Ernest Rose, D.D.S.; Joginder Lal, M.Sc.Tech., Ph.D., and Richard Green, M.S., Philadelphia

Considerable data have been published on the accelerated polymerization of various monomers by the use of amine promoters and peroxide catalysts.[1-7] Little information appears in the literature on rates of polymerization of monomer-polymer slurries such as are used commonly in dentistry.

The shorter the time at which the peak temperature appears, the faster these materials will harden. Thus, time of occurrence of peak temperature is an approximate way of measuring setting time.

EXPERIMENTAL PROCEDURE

This study was conducted to establish base data on the changes in rate of polymerization produced by varying the concentration and kind, or both, of three ingredients of self-curing resins one at a time, keeping the other two constant. The three ingredients were hydroquinone

The research reported herein was conducted under contract AF 18(600)-461 with the U.S. Air Force School of Aviation Medicine between July 1, 1953, and January 1, 1955.

Polymer research department, H. D. Justi & Son, Inc.

1. Procédé pour la fabrication de matières synthetiques. French specification 883,679, July 12, 1943.

2. Horner, L., and Schwenk, E. Über die Polymerisation von Vinylverbindungen durch das System: diacylperoxyd-tertiäres amine. Justis Liebigs Annalen der chemie 566:69, 1949.

3. Hurdis, E. C. Controlling polymerization of polyhedric alcohol esters of alpha olefinic dicarboxylic acids with ethylenic monomers. U.S. Patent 2,480,928, Sept. 6, 1949.

4. Knock, F. E., and Glenn, J. F. Dental material and method. U.S. Patent 2,558,139, June 26, 1951.

5. Lee, M. M. Process of promoting polymerization. U.S. Patent 2,647,878, Aug. 4, 1953.

6. Davenport, R. M., and Brauer, G. M. Effect of accelerators on the polymerization rate of methyl methacrylate. (Abst.) J. D. Res. 33:695 Oct. 1954.

7. Lal, J., and Green, R. Effect of amine accelerators on the polymerization of methyl methacrylate with benzoyl peroxide. J. Polymer Sc. 18:403, 1955.

inhibitor, amine promoter and peroxide catalyst.

The method of comparing the different rates of polymerization consisted of determining the temperature rise and the time of its peak, as reported by Wolcott, Paffenbarger and Schoonover.[8] Slurries containing 2 Gm. of polymer and 1 ml. of monomer were polymerized in cylindrical polyethylene molds with glass slabs on top and bottom to contain the mixture. The temperature was measured by using a 20 gauge iron-constantan thermocouple attached to a Leeds and Northrup no. 8662 portable precision potentiometer. (Wolcott used a finer, 36 gauge, thermocouple in his work, so that there may be minor differences in results reported.)

The thermocouple junction was placed at the geometric center of the 200 cu. mm. mass of slurry through a small hole drilled in the side of the polyethylene mold. (Polyethylene molds were used because it was found that rubber, as described by Wolcott and his co-workers, had a tendency to inhibit polymerization at the point of contact with the slurry.)

The peak temperature was recorded in millivolts and converted to degrees Centigrade by the use of tables provided by the manufacturer of the instrument. The time of occurrence of the peak temperature was recorded in minutes and seconds. Where experiments were conducted in duplicate, average temperatures were indicated in the data.

The same batch of finely ground polymethyl methacrylate was used as the standard material for all the experiments in this study, except for the one presented concerning the effect of particle size on the rate of polymerization. The screen analysis (in which Tyler screens were used) was as follows: on 60 mesh, 0.6 per cent; on 80, 1.0 per cent; on 100, 4.0 per cent; on 150, 51 per cent; on 250, 39 per cent; on 325, 5.0 per cent, and through 325, 0.4 per cent.

The residual peroxide as determined by iodometric titration was 0.6 per cent. The molecular weight as determined by the viscosity method was 700,000. Percentages of peroxide as indicated in the data given represent only the quantity of peroxide added and do not include the 0.6 per cent residual peroxide mentioned previously. (Residual peroxide, of course, varies from polymer to polymer, but the average commercial methyl methacrylate polymer will contain about this amount of residual catalyst.)

The monomer used in these experiments was distilled methyl methacrylate, with hydroquinone and amine added in percentages as indicated.

RESULTS AND DISCUSSION

Figure 1 shows the effect of varying concentrations of dimethyl-p-toluidine on the time of occurrence of the peak temperature during polymerization. Three curves are shown presenting the amine variations where the benzoyl peroxide catalyst was kept constant at 1, 2 and 3 per cent, respectively, while the amine concentration was varied from 0.25 per cent to 0.75 per cent.

Figure 2 demonstrates the increase in magnitude of peak temperatures produced as the amine concentration was increased. Here again, three concentrations of benzoyl peroxide were maintained constant, and the effect of increasing amine concentration from 0.25 per cent to 0.75 per cent is shown.

The data presented in Figure 1 are plotted differently in Figure 3 to show the decrease in time of occurrence of peak temperatures as the peroxide concentration was increased. Studies included three concentrations of amine (0.25 per cent, 0.50 per cent and 0.75 per cent).

Figure 4 shows the increase in magnitude of peak temperatures with increas-

8. Wolcott, R. B.; Paffenbarger, G. C., and Schoonover, I. C. Direct resinous filling materials: temperature rise during polymerization. J.A.D.A. 42:253 March 1951.

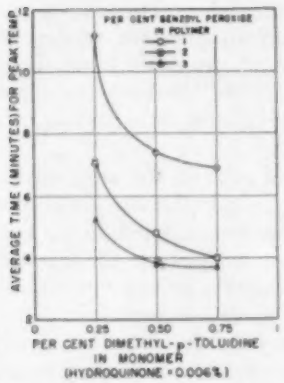


Fig. 1 • Effect of amine concentration on time of occurrence of peak temperature during polymerization

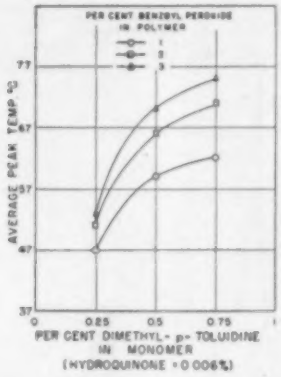


Fig. 2 • Effect of amine concentration on peak temperature during polymerization

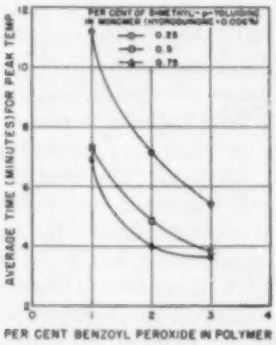


Fig. 3 • Effect of peroxide concentration on time of occurrence of peak temperature during polymerization

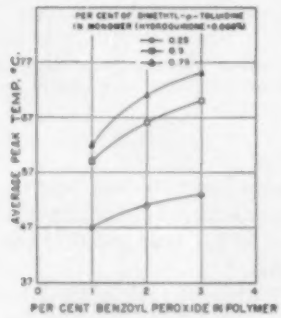


Fig. 4 • Effect of peroxide concentration on peak temperature during polymerization

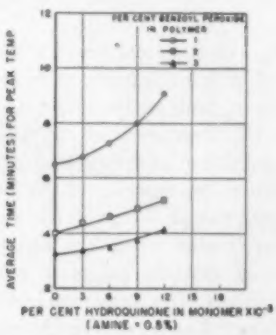


Fig. 5 • Effect of inhibitor concentration on time of occurrence of peak temperature during polymerization

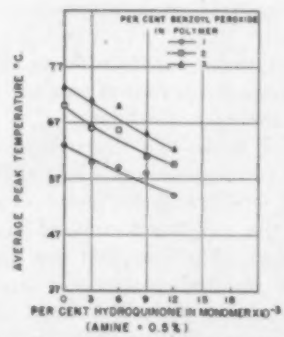


Fig. 6 • Effect of inhibitor concentration on peak temperature during polymerization

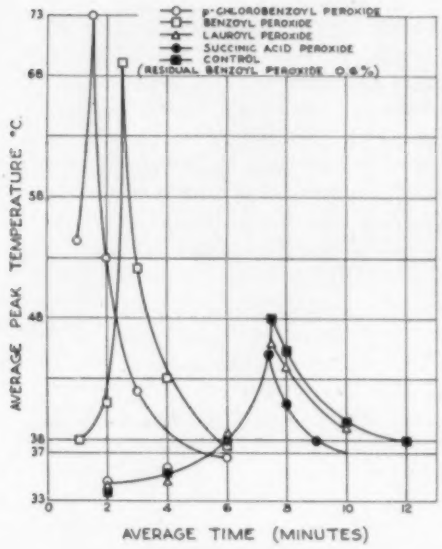


Fig. 7 • Effect of different peroxides on rate of polymerization (concentration of amine in monomer, 0.5 per cent)

ing peroxide concentration when amine concentrations were held constant at 0.25 per cent, 0.50 per cent and 0.75 per cent respectively.

Figure 5 illustrates the effect of increasing amounts of inhibitor on slurries containing 1 per cent, 2 per cent and 3 per cent benzoyl peroxide, with the concentration of amine promoter kept constant at 0.5 per cent. As expected, the time of occurrence of peak temperature was lengthened.

Figure 6 shows the decrease in magnitude of peak temperatures caused by increasing amounts of inhibitor.

Figure 7 shows the time-temperature curves of two aromatic and two aliphatic peroxides which may be useful as catalysts in the polymerization of methyl methacrylate. The fact that the control contained residual peroxide in amount equivalent to 0.6 per cent benzoyl peroxide explains its polymerization. In this experiment, the monomer contained 0.5 per cent dimethyl-p-toluidine and 0.006 per cent hydroquinone. The efficiency of the p-chlorobenzoyl peroxide appears greater than that of the other three. For each peroxide shown, the molar equivalent of 2 per cent benzoyl peroxide was added to the polymer.

Figure 8 presents the same study as in Figure 7 except that the amine concentration was constant at 0.25 per cent.

In order to illustrate the necessity for using a standard polymer in polymerization rate studies, experiments were conducted to show the effect of the particle size of polymer on the time of occurrence and the magnitude of peak temperatures. A portion of the standard polymer was screened carefully, and five fractions were studied: the material on 60 mesh, on 100 mesh, on 150 mesh, on 250 mesh and through 250 mesh. (Tyler screens were used for the separation.)

Figure 9 shows the results and indicates that a very large increase in rate of polymerization occurs as the polymer becomes finer than 100 mesh. The time of polymerization is shortened drastically, and the temperature produced by the reaction is considerably higher. A difference of about 12 minutes in the times of occurrence of peak temperatures was observed between polymer finer than 250 mesh and polymer coarser than 100 mesh. In each of the three curves, peroxide, amine and hydroquinone were kept constant at 2, 0.5 and 0.006 per cent respectively.

The effect of three classes of amines on the rate of polymerization as evidenced by the time of peak temperature is shown in Figure 10. Two aromatic amines (dimethyl-p-toluidine and dimethyl aniline) were shown to be superior to the heterocyclic methyl morpholine and the aliphatic tri-n-butylamine using the same concentration of benzoyl peroxide catalyst. The latter is not effective at mol percentages less than 1.5 as related to dimethyl-p-toluidine, which is rather effective at 0.2 per cent. Figure 11 shows the magnitude of peak temperatures for the same amines.

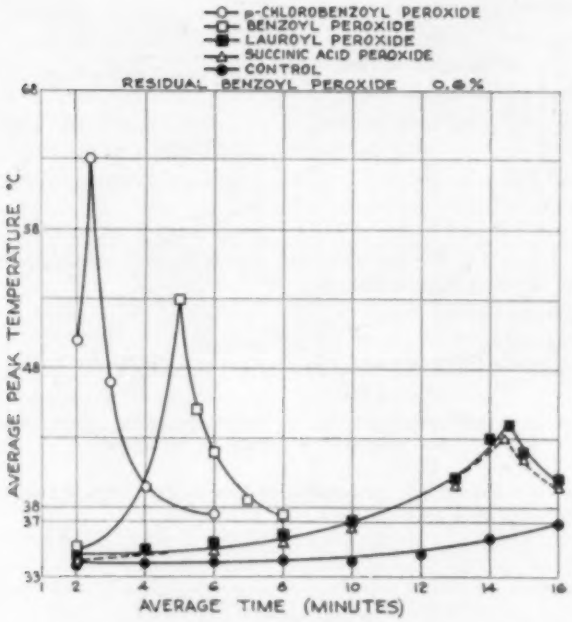


Fig. 8 • Effect of different peroxides on rate of polymerization (concentration of amine in monomer, 0.25 per cent)

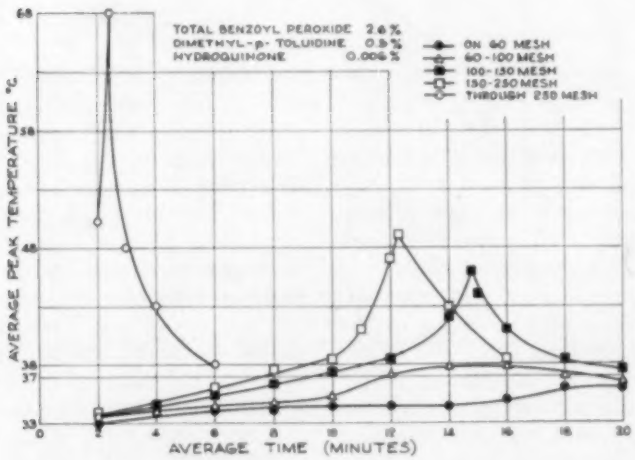


Fig. 9 • Effect of particle size of polymer on rate of polymerization

Here are seen even larger differences in the effectiveness of the two aromatic amines in contrast to the others. Dimethyl-p-toluidine produced considerably higher peak temperatures at given molar concentrations.

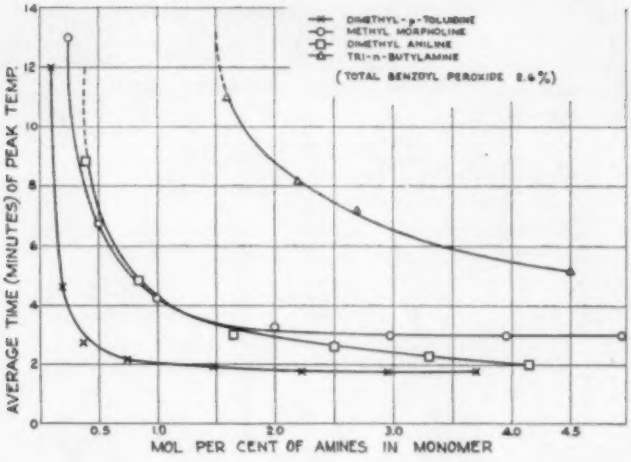


Fig. 10 • Effect of different amines on time of occurrence of peak temperature during polymerization

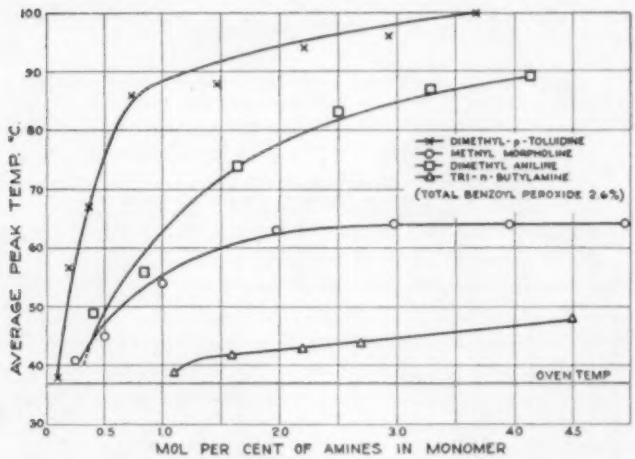


Fig. 11 • Effect of different amines on peak temperature during polymerization

SUMMARY

A study was made of the effects of hydroquinone inhibitor, amine promoter and peroxide catalyst on the rate of polymerization of polymethyl methacrylate slurries. The concentration and kind, or both, of the peroxide, amine and hydroquinone were varied one at a time. The rates of polymerization were compared by determination of the temperature rise and time of its peak.

The following effects were noted:

1. Increasing amounts of benzoyl peroxide catalyst or dimethyl-p-toluidine

promoter shortened the time of occurrence and increased the magnitude of peak temperatures in the polymerization of activated polymethyl methacrylate-methyl methacrylate slurries.

2. There appeared to be a maximum useful concentration of amine at about 0.75 per cent.

3. There appeared to be a maximum useful concentration of peroxide at about 2.0 per cent.

4. Increasing amounts of hydroquinone inhibitor in the monomer lengthened the time of occurrence and decreased the magnitude of peak temperatures.

5. Of four peroxides studied, the aromatic peroxides (particularly p-chlorobenzoyl peroxide) appeared to be the most efficient catalysts.

6. The aliphatic peroxides showed no significant catalytic effect at normal amine concentrations.

7. The rate of polymerization of self-curing resins changed greatly with the particle size of the polymer. Fine powder speeded up the rate.

8. Of three classes of amines studied, the aromatic amines were the most effective promoters at low concentrations. The aliphatic amine (tri-n-butylamine) was the least active.

3123 Spring Garden Street

An improved root canal cement

Louis I. Grossman, D.D.S., Dr.med.dent., Philadelphia

Gutta-percha as a filling material for root canals has been in use for more than 100 years, having been introduced by Bowman.[1] Silver cones, though more recent, have been in use for nearly 40 years, and were introduced by Trebitsch.[2] Many other solid filling materials have been tried and discarded in favor of these two.

Combinations of gutta-percha and various waxes were tried by me, but the resultant material was found too brittle to be of practical use. Similarly, combinations of hard paraffin and earth waxes with a radiopaque filler were tried but were unsatisfactory. When methacrylate resins became available, a combination of a polymer cone and a monomer solvent was tried, but when a radiopaque filler was added the cones did not meet the requirements of a suitable root canal filling material.

A principal advantage of the materials mentioned is that each one could be molded to the shape, size and taper of root canal instruments, thereby insuring a precision fit. Gutta-percha cones are rolled by hand and cannot be reproduced precisely. To give them proper stiffness the butt end is purposely rolled thick. This procedure often causes the cone to bind in the canal before the apical end reaches the apical foramen. No doubt a suitable substitute will be found for gutta-percha cones—one having greater rigidity so that the cone will not bend readily while being introduced into the root canal and one which can be molded

Professor of oral medicine, School of Dentistry, University of Pennsylvania.

1. Haverstick, E. E. History of dentistry in Missouri. Fulton, Mo., Ovid Bell Press, 1938, p. 423.

2. Trebitsch, H. Über die Verwertung der heilkraft des Silbers. Zahnärztl. Rdsch. 38:1009 June 16, 1929.

to conform to the size and shape of the root canal as prepared by standard root canal instruments.

Silver cones have two disadvantages: they are too soft and flexible to be introduced into narrow canals, and the butt end cannot be removed easily once the cone has been cemented in the root canal. A substitute for silver cones has been tried in the form of stainless steel suture wire. This material, because of its stiffness, is an improvement over silver cones because it can be introduced in any root canal where a root canal instrument can be inserted. In common with silver cones, it has this disadvantage—the butt end cannot easily be removed after the cone has been cemented. Its superiority lies in its possession of sufficient stiffness to make it capable of being passed to the apical foramen of even a very narrow root canal.

Whether a gutta-percha or a silver cone is used, or some substitute, a special cement must be employed to anchor the cone to the canal wall, and to fill in the interstice. In addition to the cement described in this paper, I have done considerable work with epoxy resins and these hold out much promise as a suitable cementing agent for use in endodontic practice.

Root canal cements of various kinds, to be employed in conjunction with a gutta-percha or silver cone, are in common use. They may be of the oxyphosphate type, which is not used in this country; they may be of the absorbable, or absorbable-nonabsorbable type used in Europe and South America, or they may be of the nonabsorbable type used more commonly in this country and elsewhere.

The nonabsorbable type of root canal cement is essentially a combination of zinc oxide, resin and precipitated silver. A cement of this type, Kerr's sealer, I found to set too rapidly and developed a slower setting cement consisting of zinc oxide, Staybelite resin and silver.[3] Experimental work with this cement was carried out in dogs by implanting the cement in cavities prepared in the tibias, and by purposely overfilling the root canals of the dogs' teeth. Study of histologic sections showed the cement to be practically nonirritating.

Cements containing precipitated silver are subject to oxidation and the formation of sulfides which cause the cement to become dark gray. Any excess cement left in the pulp chamber before a permanent restoration is inserted might darken the crown of the tooth, either by shimmering through the enamel if it is thin, or by diffusion into the dentinal tubules. In instances in which a permanent restoration is placed immediately after filling the canal and before the root canal cement has had time to set, darkening of the tooth is likely to occur. Even when the excess cement is removed from the pulp chamber after it has had time to harden, discoloration at the cervix of the tooth may occur because of alveolar and gingival recession. This knowledge prompted me to develop a nonstaining cement.

NONSTAINING ROOT CANAL CEMENT

Essentially all root canal cements are modifications of zinc oxide-eugenol cement adapted for special use in the root canal. The properties expected of a root canal cement are as follows:

1. It should seal the root canal hermetically.

2. It should not change in volume on setting.

3. It should adhere to the canal surface even when slight moisture is present.

4. It should be well tolerated by the periapical tissue if extruded beyond the apical foramen.

5. It should have good working qualities when mixed.

3. Grossman, L. I. Filling root canals with silver points. D. Cosmos 78:679 July 1936.

6. It should be introduced easily into the root canal.

7. It should give the operator sufficient time to make any adjustment of the gutta-percha or silver cone that may be necessary before initial setting of the cement.

8. It should set hard in the root canal.

9. It should not discolor tooth structure.

10. It should have some bactericidal or bacteriostatic effect.

These requirements are fulfilled to a great degree in the cement developed by the author, the composition of which is as follows:

Powder	
Zinc oxide, C.P.	40 parts
Staybelite resin	30 parts
Bismuth subcarbonate	15 parts
Barium sulfate	15 parts
Liquid	
Eugenol, C.P.	5 parts
Oil of sweet almond	1 part
Pass through 100 mesh sieve.	

This cement has smooth working qualities, plasticity, adhesiveness and radiopacity. The Staybelite resin gives the cement adhesiveness, the bismuth subcarbonate gives it a smooth working property while being mixed and the barium sulfate gives it greater radiopacity. The oil of sweet almond retards setting so that it takes about 20 minutes from the time of insertion in the root canal until the initial set takes place. This allows time for adjustment of the cone, if needed. The eugenol should be reasonably fresh and light in color. Eugenol which is dark in color has already undergone oxidation, has absorbed moisture from the air and will tend to hasten the setting of the cement. When properly mixed, the cement is a white, creamy color, smooth as cream and without minute granules. It should be emphasized that the quality of the finished cement will depend on the purity of the ingredients used, their formulation, and care used in mixing the cement.

MIXING THE CEMENT

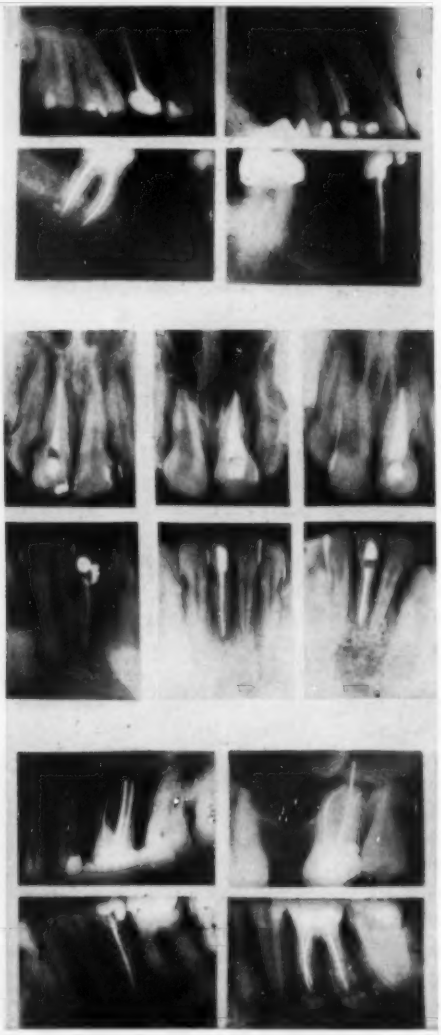
Especial care should be used in mixing the cement, otherwise a granular, rapid-setting cement of poor quality will result. The cement powder should be placed on a sterilized glass slab. The slab may be sterilized by swabbing it with untinted nitromersol or with mercocresols, then swabbing off the excess with alcohol. The spatula may be sterilized by passing it through the flame three or four times. Two drops of the cement liquid are placed on the slab for filling an anterior or bicuspid tooth, whereas three drops of liquid should be used for a molar. No more than three drops of liquid should be used at a time because of the excessive time and effort it would take to spatulate a larger amount.

Spatulation of this cement differs noticeably from spatulation of the oxyphosphate cement, or of zinc oxide-eugenol cement, or even of the silver root canal cement. It should be a slow, deliberate process in which very small portions of powder are completely incorporated into the liquid. As much as two or three minutes of spatulation is often necessary for each drop of liquid. At the completion of spatulation, the wrist often is tired, but repeated spatulation will strengthen the wrist muscles and eventually make the operation of mixing less tiring.

TESTING THE CEMENT

There are four tests for determining whether the cement has been mixed to proper consistency:

1. While the cement is being paddled rapidly back and forth, small globules or drops of cement should not be shed from the spatula.



Examples of teeth filled with root canal cement

2. Slight resistance to spatulation of the cement should be felt as the correct consistency is approached.

3. When the cement is gathered together on the spatula and the latter is held edgewise, the cement should not drop off the edge of the spatula in 15 seconds.

4. When the cement is returned to the slab and the flat surface of the spatula is slowly raised, the cement should string out for at least 1 inch without breaking.

The cement will not set hard on the slab for at least eight hours. In the root canal, because of moisture present in the dentinal tubules, it will begin to set hard in about 20 minutes.

The cement is soluble in chloroform, carbon tetrachloride, xylene or ether. While still soft, it is easily removed from the glass slab with a disposable napkin or gauze which has been moistened with alcohol. A drop or two of chloroform will facilitate the removal of any residue. If the cement has become hard, it should be scraped off the slab with a spatula. The remainder adhering to the glass may be removed with chloroform.

REMOVAL OF ROOT CANAL FILLING

If it should be necessary to remove a gutta-percha root canal filling, a few drops of chloroform are discharged into the pulp chamber by means of an irrigating syringe. The chloroform is then worked up into the root canal with a sterile reamer or file. As it dissolves both the gutta-percha and cement, the resultant paste is removed and more chloroform is worked up into the canal with an instrument. This procedure is repeated until all the gutta-percha and cement are removed. To insure thorough removal of small particles, the root canal may be irrigated carefully with chloroform.

If the cement is used in conjunction with a silver cone, removal of the cone is more difficult. The chloroform should be worked up around the cone with a fine root canal instrument in order to dissolve the cement. Once the cement has been dissolved, an effort is made to remove the cone by engaging it with a pair of cotton pliers or narrow beak forceps, such as Stieglitz forceps, twisting and rotating the cone in order to tease it out of the canal.

CLINICAL USE

The root canal cement developed has been used clinically in a large number of root canals. In some instances the cement has been carried through the apical foramen in contact with the periapical tissue without observable reaction. The cement is apparently nonirritating to the periapical tissue. A few teeth which have been filled with this material are shown in the illustration. In some instances the root canal has been overfilled without any reaction.

SUMMARY

A new formula for a root canal cement is given. This cement is adhesive and will not discolor tooth structure. It allows the operator about 20 minutes in which to make correction of the root canal filling, if necessary, before hardening. The cement is soluble in ethereal solvents and can be removed from the root canal. The cement has been used clinically and appears to be nonirritating to the periapical tissue.

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A modified epoxy resin as a denture base material

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The dental profession is constantly seeking to improve the materials in use today, or is seeking new materials which will give its practitioners better clinical results. In keeping with this idea, the development of a new denture base material with properties not available in existing denture base materials will be discussed.

In the fabrication of dentures, a molding material having certain specific properties is required. The material must be hard but not brittle, in order to withstand reasonable usage. It must be capable of being molded easily at room temperature (68° $F_.$). It must be nontoxic and unaffected by saliva and substances normally taken in the mouth. It must be capable of easy repair if broken, and of being tinted to resemble closely the normal color of oral mucosa.

Denture base materials that were used earlier are rubber, nitrocellulose, methyl methacrylate resin, styrene resins and glass. The most widely used materials were rubber and methyl methacrylate.

A research development of an entirely new thermoset epoxy resin denture base material being tested at the University of Washington, School of Dentistry, now permits presentation of this preliminary report.

MOLDING PROPERTIES

The most significant property of epoxy resin is its liquid state during molding. Hitherto, all denture molding has required both considerable pressure and heat. As a result, it became nearly im-

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possible to reproduce accurately a trial denture in a more permanent material. Expansion of investing material and 4 per cent expansion of methyl methacrylate during curing at high temperatures and consequent 6 per cent by volume contraction[1] of these same materials on cooling regularly produced an open-bite relation that required grinding and milling of the teeth to eliminate occlusal disharmony. It has been postulated that the use of extreme pressures during molding contributes toward this processing error by intrusion of teeth into the investment material.

Epoxy resin flows readily and slowly. Before and after mixing it has the consistency of syrup at ordinary temperatures. All earlier molding procedures are eliminated by simply pouring resin into the molds, no water bath being required. Artificial teeth need no longer be mutilated by postcure grinding and therefore remain more efficient, esthetic and comfortable to the patient.

MIXING

In order to make the molding stock resin adaptable for fabrication, one part of a special curing agent is mixed into ten parts of tinted modified epoxy resin. The denture flask is specifically designed with two or more 5/16 in. diameter openings to facilitate pouring of the mixed resin. When the denture is flasked, wax sprues are led through these openings (see figure).

POURING AND CURING

When the denture pattern is eliminated, the flask is thoroughly cleansed, dried, and all denture surfaces are treated with two applications of a mold release medium. When dry, the flask is clamped shut and supported vertically with sprues pointed upward. The premixed epoxy resin is then poured in through one sprue opening only. When the flask is filled and excess emerges through the opposite sprue exit, it is maintained in a vertical position and cures into a solid mass, at 120°F., overnight.

No fluid curing bath is required in processing epoxy resin. Ideally, the processing should be done with dry heat at 120°F. Moreover, the curing time is diminished in direct proportion with the increase in heat. This relation between increased heat and rapidity of processing is not a linear relationship nor does it apply above 160° F., as the exothermic heat developed at this temperature could distort the final product. Temperature changes of 70° F. (68° F. to 138° F.) have not produced any deleterious effect on finished dentures. The processing can be carried out in a simple thermostatically controlled oven which will control the temperature at 120°F.

When making heat-cured prosthetic bases, the plastic (methyl methacrylate) will contract when cooled from polymerization temperature (70° C.-100° C.) to room temperature. This will draw the vestibular flanges of the prosthesis together by as much as 1 mm., as has been proved by linear measurements across the molar region.[2-5] One millimeter is equivalent to .039 in. The amount of contraction is .99 per cent.

A series of denture blanks were fashioned in which metal pins had been processed in the region of the central fossa of the second molars. On measuring this series of denture blanks prior to initial removal from the model and comparing these measurements with those made one week after removal from the model, the

1. Tylman, S. D., and Peyton, F. A. Acrylic and other dental resins used in dentistry. Philadelphia, J. B. Lippincott Co., 1946, p. 125.

2. Hedegard, Bjorn. Cold-polymerizing resins: a clinical and histological study. Acta Odont. Scandinavica 13:41, suppl. 17, 1955.

3. Kern, W. R. Possible dimensional changes in denture base materials. J.A.D.A. 28:1952 Dec. 1941.

4. Skinner, E. W., and Cooper, E. N. Physical properties of denture resins: part I, Curing shrinkage and water sorption. J.A.D.A. 30:1845 Dec. 1943.

5. Skinner, E. W. Acrylic resins: an appraisal of their use in dentistry. J.A.D.A. 39:261 Sept. 1949.

shrinkage was .002 in. by linear measurement across the molar region. The amount of contraction was .05 per cent.

REPAIRING

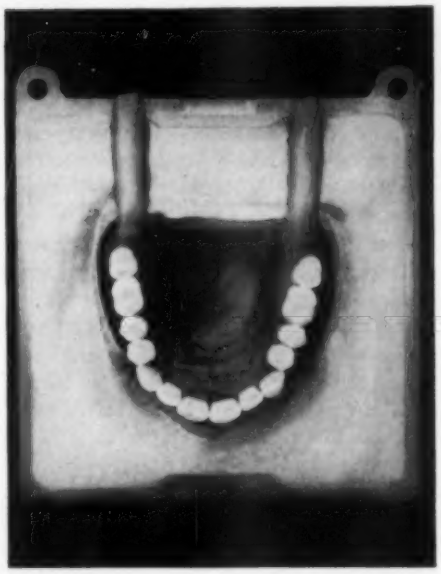
Another property of epoxy resin is an ability to bond rigidly to many other substances, more particularly to metals, glass and porcelain. Fortunately, it bonds readily to itself, thereby resolving the repair problem in dentures. With different repair technics, different amounts of hardening agent will decrease the curing time to a minimum of 40 minutes.

The curing agent is not a catalyst acting on the resin, but rather is incorporated into the mass and becomes a part of the product. Shrinkage during curing is evident only at the point where poured, or in the sprues. No significant shrinkage takes place in the denture base. Such a shrinkage takes place in the reserve of material present at the point of pouring; the denture mass shows no significant contraction nor shrinkage.

TOXICITY EVALUATION

Any material used in the oral cavity should be extensively tested for toxic reaction, because it is the toxicity of many substances which limits the materials available to the prosthodontist. In testing for toxicity, the usual procedure is to test the component parts of the material prior to mixing, then to test a fully cured specimen of the material. Methyl methacrylate is toxic in its liquid state. Consequently, most of the toxicity testing procedures have revolved around this monomer (liquid).

Deichman,[6] in a series of animal experiments, found that liquid methyl methacrylate has a toxic effect when applied locally to the skin, and on the mucous membrane when inhaled. When air mixed with monomer (19 mg. of monomer to one liter of air) was inhaled constantly, the test animals died in 2½ to 5 hours. Spealman[7] and co-workers found, however, that the effect of the monomer is not particularly cumulative. Although exposed intermittently for three hours per day for 15 days to a concentration as high as 29 mg. of monomer per liter of air, their test animals survived. In 50 per cent of the patch tests to which they subjected the forearms of 50 medical students who had not previously been exposed to liquid methyl methacrylate, the results were toxic reactions in the form of an erythema, whereas patch testing with fully polymerized material caused no reactions in the group of 50 test subjects. The observations of Spealman and co-workers were confirmed by Brunel[8] who found



Method of flasking waxed-up denture. Note that flask must have flat base

6. Deichman, W. Toxicity of methyl, ethyl, and n-butyl methacrylate. J. Indust. Hyg. & Toxicol. 23:343 Sept. 1941.

7. Spealman, C. R., and others. Monomeric methyl methacrylate studies on toxicity. Indust. Med. 14:292 April 1945.

8. Brunel, M. Les manifestations buccales d'intolerance aux resines methacryliques. Thèse de l'Université de Paris, 1948.

16 positive reactions in 20 test subjects (80 per cent positive) to patch testing with pure liquid methyl methacrylate in individuals previously never exposed to the monomer. Rink[9] has stated that residual monomer has a strong toxic effect when brought into contact with human tissues.

The most toxic component of epoxy resin is the undiluted curing or hardening agent. In a series of patch tests where the hardening agent was applied to the flexor surface of the forearm of 50 dental students, it was found that eight, or 16 per cent of the test group, had positive reactions and six had slight erythema after 24 hours of continuous contact with the material. Two subjects had vesicle formation.

The toxicity of the uncured resin, the other component, is relatively low. The oral administration of more than 7 cc. of one of the epoxy resins per kilogram of body weight was tolerated by white mice without symptoms.[10, 11]

CLINICAL TESTS

Epoxy resin has a very low water sorption factor after it is cured, in comparison with that of other denture base materials; volumetric changes in use are reduced therefore. It is strong, yet impact-resistant, and is nontoxic on contact with living tissues.

To this date, over 225 dentures have been inserted clinically in all possible denture combinations. Tooth-grinding after curing has been unnecessary in all instances. Patients who previously had worn dentures report a high degree of masticating efficiency and appreciate the fact that the cusps do not have to be altered or modified in any respect. Retention and stability of dentures are excellent. Denture base changes are virtually nonexistent to date. Future reports will deal with exactness of denture base form at 6, 12, and 18 month postinsertion periods.

FINISHING

Removing cured dentures from the flask is difficult unless the mold release agent is applied properly. All other procedures for denture removal from investing material are standard.

Grinding and polishing technics are slightly different because of the surface density of epoxy resin. Burs rather than stones are used for trimming. Any trained technician soon learns to alter procedures to achieve a desirable high gloss polish. The time loss factor is insignificant here because of the great amount of time saved through elimination of the need for remounting or tooth grinding.

SUMMARY

An evaluation of a new denture base material has been made. A comparison with resins now in use by the dental profession has indicated the new material has the following advantages: (1) more permanently accurate reproduction of contour of mold; (2) less water sorption; (3) greater ease of processing; (4) less volumetric and linear shrinkage; (5) less initial expansion; (6) greater impact-strength or resistance to fracture; (7) less distortion after removal from the mold; (8) much less movement of teeth in the course of processing, thereby greatly reducing or eliminating the need for spot grinding and milling; (9) reduced toxicity; (10) greater ease of repair.

9. Rink, G. Studien über die Polymerization und die Mangel der heutigen Verarbeitungsweise der Kunststoffe. Deut. Zahnarztl. Zschr. 7:1293 Nov. 1952.

10. Recommendations for the handling of epoxy resins and their formulations. Tech. Bull. Sc. 55:27 July 1955.

11. Bowen, R. L. Use of epoxy resins in restorative materials. J. D. Res. 35:360 June 1956.

Wanted: a re-evaluation of the profession's philosophy regarding manpower

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Manpower in dentistry, with its many attendant problems and questions, presents an immediate and long-range challenge to every dentist and dental society, as well as to those in the field of dental education and to legislative assemblies. The status of dentistry as a profession in society, in this and future generations, may be determined in a large measure by present planning.

Those in the profession and other interested parties cannot escape the fact that the population is increasing at a much faster rate than the rate at which new dental manpower is being added. There are some 11,200 Americans born every day, about 500 people are added by immigration, and approximately 4,300 die. This represents a net gain of some 7,400 per day in the population of the United States, or about two and one half million per year.[1]

The problems relating to restorative dentistry and other dental services are extremely important to the successful conduct of a practice, and these subjects should continue to capture the attention of all in the profession. The questions or problems with reference to (1) who is going to render the dental services and (2) under what conditions, however, in reality become all important items which will affect the economy and stature of the individual dentist and the profession.

It seems important for the profession again to re-evaluate its basic philosophy relating to the reasons for its existence, the patterned objectives as expressed in everyday practice and the programs and broad operational policies.

The questions of whether there is a clear concept within the minds of the majority of the profession as to the meaning of the terms "need for dental service" and "demand for dental service" and of whether it is now the basic philosophy of the profession to provide dental manpower in response to "effective demand for dental service" should be considered. For the purposes of this discussion, the term "effective demand" refers to the demands represented by (1) those individuals who can pay the private practitioner a reasonable fee for required dental service; (2) contractual arrangements with city or state welfare agencies, foundations, unions, insurance companies or federal agencies for payment of prescribed dental treatments and (3) the Armed Forces dental services.

A reasonably clear and understandable blueprint which has the strong support of the profession and which gives direction to educational institutions and legislative assemblies in terms of dental manpower requirements must be established,

Dean, School of Dentistry, University of North Carolina, and consultant to the Office of Defense, Assistant Secretary of Defense (health and medical).

1. Kirk, Dudley. The character and implications of population trends in the United States. Presented at W. K. Kellogg Foundation Conference, "A look to the future," Battle Creek, Mich., June 21, 1956.

especially at the state level, if rational, effective and efficient planning is to be realized.

States vary greatly in their immediate and long-range potentials in regard to economy and population increases, and, therefore, a national formula cannot be applied effectively. If the basic philosophy of a state dental society is that dental manpower should be made available in line with the "effective demand for dental service," then care and judgment must be directed to present and future economic considerations. If the dental society directs its attention to furnishing dental manpower to care for the total dental needs of the state's present population and its potential future population, then there would be a vast difference in its basic concept regarding manpower development.

With the considerations regarding dental needs and demand for service, there is the necessity for evaluating the basic philosophy regarding the function of the individual dentist and the utilization of his skills. For example, a high percentage of the average dentist's time now is wasted because he does not utilize effectively his special skills and knowledge. Accordingly, if the profession actively pursued the problems and potentials for the greater utilization and productivity of the individual dentist's skills and knowledge through the effective use of auxiliary personnel, the requirements for producing more dentists would be viewed in an entirely different perspective.

Fortunately, studies of great importance have been made in the immediate past and, also, are being conducted currently by men with experience, knowledge and interest concerning this important problem. One such study involving 1955 data, which is reported on with predictions and recommendations in the book, *Dental Manpower Requirements in the West,* was made by the Western Interstate Commission for Higher Education (WICHE) in cooperation with the W. K. Kellogg Foundation and the Council on Dental Education of the American Dental Association.[2]

The WICHE study has given consideration primarily to the need for additional dentists and dental hygienists, but it is my opinion that there are several other important potentials which must be evaluated in making an approach to the solution of the critical dental manpower problem. It is believed that a very favorable impact on the dental manpower requirement may be realized as a result of a change in the basic pattern of thinking by the profession. Such a change in philosophy relates to the roles which such factors as preventive dentistry, the migration of dentists and the dental assistant may play in reducing the total need for dentists in a given state or in the country.

The comments which follow will be directed to the present day ideas of dental manpower needs on the part of many leaders in the profession and, further, to an evaluation of the several additional potentials already mentioned.

NUMBER OF DENTISTS NEEDED OR REQUIRED

The basic philosophy of the profession regarding its immediate and long-term objectives and its reasons for existence must again be evaluated or assessed with respect to the question of how many dentists are needed or required. When a dentist, dental society, the American Dental Association, the House of Delegates, a legislature, a public health administrator or a college president considers this question, is the total need of the total population under consideration, or is the very important question of today's demand for dental service being considered?

A report by the Bureau of Economic

2. Western Interstate Commission for Higher Education and U. S. Public Health Service, Division of Dental Resources. Dental manpower requirements in the west. Washington, D. C., Government Printing Office, 1956.

Research and Statistics of the American Dental Association indicates that the national ratio of active dentists to total population is approximately 1:1,900.[3] The report further states:

> Ratios of population to dentists will never be and should never be equal among all counties or even among states. There is geographic variation in needs for dental care, economic conditions, and appreciation of dental health.

A report further evaluating dental manpower needs was made before a congressional committtee by the American Dental Association. The report supported the views of the Council on Dental Education, the Bureau of Economic Research and Statistics of the American Dental Association and the U. S. Public Health Service. The following item concerning the report was published in the April 1, 1957 *A.D.A. News Letter*:[4]

> While the number of dental graduates has risen steadily in recent years, the number is not great enough to replace dentists who die or retire and to keep pace with the population growth, the report said. It is estimated that there were 58 active dentists for every 100,000 persons in 1930 as compared with 46 to 100,000 in 1955. "The American Dental Association has estimated that two new schools (or the equivalent expansion of existing schools) would be needed in each year from 1957 to 1971 in order to assure that the 1955 ratio would prevail in 1975," the report said.

The following important and highly significant statement was made regarding the WICHE study: "WICHE sponsored a study of dental manpower in the West so the states might accurately determine their needs for additional dental schools and dental education."[4] The states and territories included in this study were Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, Alaska and Hawaii. For example, this publication states that California had 7,144 active dentists in 1955 and that the estimated supply would be only 9,121 by 1975. In this projection, California would require 12,965 dentists by 1975 to maintain the 1955 ratio and a figure of 23,007 dentists is listed to meet the probable demands by 1975.[5]

A study comparable to that conducted by WICHE has been completed recently by the Southern Regional Education Board, in cooperation with the agencies listed in the WICHE study. The Southern Regional Education Board study includes 14 states.

DENTIST-POPULATION RATIO

What criteria should be used to determine a favorable dentist-population ratio? Perhaps there should be a national ratio of 1:1,000 or 1:3,000, who knows? The use of the 1:1,900 yardstick envisions the same national economy as in 1955 and the same operational economy in the actual use of the dentist. Studies with purposes similar to that of the WICHE study would encourage the profession, the state legislatures or the educational institutions to greatly expand their present dental educational facilities and to build new schools of dentistry. California, according to WICHE, had 7,144 active dentists in 1955 with an estimated population of 12,812,000, or about 1:1,800. The WICHE study gives thoughtful and valuable consideration to the critical problem in the future years immediate and more distant. The important question of who should decide and how should it be decided what ratio is most compatible and equitable for California's or any other state's economy now arises. Should the decision in any state as to the philosophy and pattern of development of the dental profession be made by a university, the state legislature, the state

3. Bureau of Economic Research and Statistics, American Dental Association. Distribution of dentists in the United States by state, region, district and county. Chicago, American Dental Association, 1956.

4. U. S. dental schools need $77 million for construction, report shows. A.D.A. News Letter 10:3 April 1, 1957.

5. Western Interstate Commission for Higher Education. Planning the next move . . . to ward off the coming shortage of dentists in the western states. Boulder, Colo., Norlin Library, 1957.

dental society or a combination of state agencies and bodies having vested interests?

An American Dental Association study shows that New Jersey had a dentist-population ratio of 1:1,493.[8] When this figure is corrected to consider only the active dentists, the ratio approximates 1:1,720. It is interesting that two new schools of dentistry have been started in New Jersey.

Few states, according to the information available to me, have a plan or an objective which has been considered and studied by the profession regarding their dental manpower requirements. Is there in reality anything more important to the profession than its place in the social structure, which is determined by the basic philosophy of the profession? Hence the question, where is the profession going and how fast.

FACTORS DETERMINING NUMBER OF DENTISTS REQUIRED

There are a number of important factors which must be considered and evaluated before a potential dentist-population ratio and, thereby, the number of dentists required at a given time can be determined. The fundamental question as to whether the ratio is intended to be on the basis of effective demand or on the basis of need cannot be avoided. Demand also can be created by government subsidies, such as the Medicare program (activated in December 1956) and those for the care of veterans, or by contracts with unions whereby these agencies pay the dentist for services rendered. Medicare presently has little or no impact on the dental profession as regards the demand for service. Potentials for a greater demand because of the Medicare program, however, are present.

If the dentist-population ratio is to be considered on the basis of present day ideas of effective demand by the private patient, then the number of dentists required in a period of economic recession would be appreciably reduced. The recommendation made by WICHE for California, namely, 12,965 dentists by 1975 to maintain the 1955 ratio, was no doubt based on present high income levels and also on the estimated growth in population. Another very important statement regarding dental manpower was given; namely, that 23,007 dentists would be required to meet the demand by 1975. In other words, a shortage of 11,042 dentists would exist in this state with respect to probable demand in 1975. It can be argued with considerable merit that plans for the constructive development of manpower should be on the basis of present day economy and that one must retain an optimistic and positive attitude regarding the future. Assuming that the positive attitude is the favored philosophy in a given state or area, the establishment of a flexible plan or pattern of operation which could absorb a temporary or perhaps a more significant economic recession is not precluded. If there is such flexibility in planning, greater emphasis will necessarily be given to preventive measures and the use of auxiliary personnel which will be discussed later.

PREVENTIVE MEASURES AND DENTAL MANPOWER

How does the factor of preventive dentistry fit into dentistry's basic philosophy concerning routine private practice and dental manpower requirements? What emphasis, if any, are the leaders and planners in the profession ready to place on prevention, which would reduce the need or requirement for dentists? Have the tons of literature from the various federal agencies, the Council on Dental Health, the state departments of health, the many scientific journals and dental schools and the thousands on thousands of hours of lectures, programs and other contacts with the public been wasted or unrealistic? I have been led to believe by

the scientific literature and research experiences that dental caries and periodontal disease can be prevented or controlled in a large percentage of the population, provided the people were willing to follow the recommendations of known preventive measures. Has the profession been a failure in "selling" the public and themselves on preventive dentistry, and is it a part of the basic planning to continue to admit failure? Nowhere in the dental manpower studies, writings or predictions has there been any suggestion that a favorable dentist-population ratio perhaps could be 1:2,500, 1:3,000 or 1:4,000. How does anyone know whether in reality there is a shortage of dentists now, in terms of effective demand, if the major effort in all areas of dentistry were directed toward prevention? It is recognized that, with the present public demand for refined carbohydrates and the vast sums of money spent for advertising such products, any appreciable reduction in the incidence of dental caries cannot be made unless there is a united and total war on caries caused in this manner.

Another important question is what type of product (graduate) is dental education producing with respect to knowledge, know-how and basic philosophy regarding prevention. Does the average student really know how to prevent or control dental caries from a practical everyday-practice point of view, or does the average graduate have the basic idea that preventive dentistry is something fine to talk about—but "let's get on with the show and do the fillings and other restorations"? How many, if any, clinical points are required in the average dental school to demonstrate that the student really knows preventive procedures with respect to caries? Does the average student know how to manage the various periodontal problems, or is this work to be delegated to the few available specialists? Does the average state board have any practical measure of a candidate's fitness to practice preventive dentistry?

Perhaps preventive dentistry is a fine thing to talk about but not a practical expedient for everyday-practice. If preventive dentistry is important, if it is practical, if the objective in the profession is to do more than emphasize only restorative procedures and if the profession is planning to do something about the manpower problem, not by producing more dentists (individuals with six or seven years of training) to do restorations, then the basic philosophy of dental education and state board examinations must be re-evaluated from this point of view. If preventive dentistry has no practical value in reducing the manpower needs and if preventive dentistry is not to be used as a basic weapon in solving the manpower problem, the future of the profession appears dismal indeed.

I believe in preventive dentistry, and I have seen it work in a practical way in many areas of dentistry. This does not mean for a moment that every student in dental school and every person appearing before every state board should not meet the very highest and exacting standards in restorative procedures. This is a must, but preventive dentistry also is a must.

The immediate question, then, is why preventive dentistry, or the potentials for preventive dentistry, is not an important factor in the determination of manpower. Is the 1955 dentist-population ratio of 1:1,900 the standard to follow in predicting how many new dental schools, how much expansion in existing dental schools and how many dental practitioners a given area or state needs in 1965 or 1975? The WICHE study has given little or no consideration to the factor of preventive dentistry for the present or the future. Perhaps preventive dentistry has no real value.

MIGRATION OF POPULATION

The migration of the population, including the migration of the dentists, becomes

another vital and real factor in determining the supply of dental manpower in a given state. When the economy of a given state or area is on the decline and other sections of the country seem to have or actually present greater opportunities, dentists also move. The state boards of dental examiners recognize this factor well, and, accordingly, they have a great responsibility to evaluate dentists from other states who seek a license. It is interesting to speculate on how many dentists California, Florida, North Carolina and a number of other states would have if the state examinations were not a requirement. The state boards can open or close the valves of the dental manpower pipeline to regulate the flow of dentists who meet the standards set forth in their examinations. To date, I have not heard of any state dental society or state board of dental examiners that has placed advertisements or made statements in dental journals to encourage more dentists to come to their respective states. A review of the number of candidates for the various state boards and the number who receive licenses will bring up an interesting practical question; namely, how much expansion in dental schools is actually required to meet the manpower needs in selected states.

MILITARY NEEDS AND DENTAL MANPOWER

The law provides for a dentist-troop ratio of 1:500 in the Armed Forces. There is no immediate explanation as to why the figure of 1:500 was selected as the optimum ratio and written into law, except that it seemed a reasonable figure at the time. There are many variables to consider in providing dental service, and, accordingly, manpower for the Armed Forces which are not evident in a civilian practice or community. For example, in a military installation designated for 10,000 troops, the actual strength varies below and above the figure from time to time as troops are moved in and out of the station. From the point of view of dental manpower, the movement of troops brings in new patients. In many of the military installations where inductees are first processed, a large percentage of the troops have had little or no dental attention. In civilian life the individual has the option to go to the dentist, but in a military installation he is required to have dental treatment to meet the minimum standards of health and function. In civilian life about 30 per cent of the population sees a dentist at fairly regular intervals, but in a military installation all of the inductees are required to have a dental examination and treatment, if necessary. Further, the dental services of the Army, Air Force, or Navy do not have all of their dental personnel active in rendering dental treatment at a given time, since a number of officers are designated for administration, research and special assignments and others are on leave or in training.

Although the present ratio of 1:500 appears to be reasonable, this ratio does not represent a valued factual figure which has been documented by critical studies. One of the great contributions the Armed Forces could make to American dentistry and to the active military establishment would be by evaluating critically and documenting the need for various classes of dental manpower. Such research studies should embrace types of installations, types of troop units, optimum use of auxiliary personnel and optimum space requirements for operations and for laboratories to permit the most efficient and economic use of personnel. During time of peace, the number of dentists in the military service presents no great handicap to the average civilian community, but in time of national emergency when 20 to 25 per cent of the available dentists may be in the Armed Forces, the shortage of dentists becomes critical.

There would be a precipitous drop in

the need for dentists in the Armed Forces if the practice of preventive dentistry could be emphasized in the profession, the community and the home. Presently, the Armed Forces must afford dental treatment to all who are eligible for induction, although the large majority of the inductees in the past have expressed little or no interest in the procurement of dental treatment or in the prevention of dental disease.

AUXILIARY PERSONNEL AND MANPOWER POTENTIAL

The WICHE report gave considerable emphasis to the potentials in an expanded program of training for dental hygienists. The report indicates, however, that for every new hygienist who is active at the end of 20 years, at least five must be trained.[2] The loss of dental hygienists from active practice, as with other women workers, is great, because of marriage and other interests. A 1957 publication of the U. S. Public Health Service indicates that about 30 per cent of dental hygienists withdraw from professional work within a year after graduation. Furthermore, by the third year after graduation only about one half are in practice.[6] The question of actual costs to the school, the state and the profession for the training of hygienists for two or more years, considering their short span of practice and service to the public, would indeed be significant and interesting.

Although the WICHE report did not indicate what benefit would be realized in the conservation of the dentist's time by the effective use of the dental assistant and, accordingly, presented no estimate of the additional number of dental assistants which would be required now or in 1975, there is considerable factual evidence that such auxiliary personnel can have a great influence on manpower needs.

The summary statement by Waterman[7] representing a five year clinical study of dental care which was carried on in Richmond, Indiana, by the Indiana State Board of Health and the city of Richmond, with the cooperation of the U. S. Public Health Service, says in part, "The effective utilization of dental assistants presents an opportunity to bring about a substantial increase in dental care services."

Coomer,[8] using as a reference the evaluating committee reports of the University of Michigan workshop to study how scientific dental service might be organized to care for more people, says:

> The dentist increases his weekly patient load approximately 36.8 per cent by employing one auxiliary, and 68.8 per cent when he employs a second. Thus, if the dentist working alone is able to render an adequate service for ten patients per day, he will be able to serve 16 to 18 patients in the same time if he intelligently uses the services of two well-trained employees provided he has at least two, preferably three, well-equipped operating rooms, and that his office is efficiently designed and adequately equipped.

In the 1953 survey of dental practice by the Bureau of Economic Research and Statistics of the American Dental Association,[9] the summary included the following statement:

> Dentists with one auxiliary employee averaged 53.8 per cent more patients than dentists with no employees; with two employees, the increase was 107.3 per cent, and with three employees, 219.3 per cent. The percentage increase in number of patients with number of employees for an entire year, as determined in this survey, was considerably greater than the increase in number of patients during a week, as determined in the 1950 Survey of the Dental Profession.

6. Pelton, Walter J.; Pennell, Elliott H., and Vavra, Helen M. Health manpower source book, section 8. Dental hygienists. Department of Health, Education, and Welfare, U. S. Public Health Service publication No. 263. Washington, D. C., Government Printing Office, 1957.

7. Waterman, George E. Effective use of dental assistants. Pub. Health Rep. 67:390 April 1952.

8. Coomer, O. B. Role of auxiliary personnel in augmenting services of the dentist. J.A.D.A. 52:442 April 1956.

9. Bureau of Economic Research and Statistics, American Dental Association. The 1953 survey of dental practice. Chicago, American Dental Association, 1954.

The 1956 Survey of Dental Practice,[10] of the Bureau of Economic Research and Statistics of the Association, presents some additional meaningful data related to income and the use of the dental assistant. Greater income reflects a greater quantity of dental service, and, thereby, the study complements the data of the 1953 survey. The mean net income of independent dentists with one chair and no employees was $7,494; with one chair and one assistant, $11,444; with two chairs and two assistants, $19,610. Also, it is interesting to note that independent dentists with two chairs and one hygienist had a mean net income of $11,603 and those with one-chair offices with one assistant had a mean net income of $11,444. If it is assumed that the 1955 income figures, the data referred to by Coomer and the 1953 survey are reasonably accurate, it can be concluded that the dental assistant can have a very favorable effect on the manpower problem and must be considered in any determination of the number of dentists that will be needed.

The 1956 survey[11] also showed that 22.9 per cent of the independent dentists in the United States had no employees, ranging from 11.0 per cent in the Far West to 40.0 per cent in the Middle East. A total of 69.5 per cent of the independent dentists in 1955 employed full-time assistants, and 8.6 per cent employed full-time dental hygienists. Only 5.1 per cent of the dentists employed two assistants. The percentage of dentists employing auxiliary personnel of any type increased from 73.1 per cent in 1952 to 77.1 per cent in 1955.

The 1956 survey also indicates that the median salary for the dental hygienist was $3,651, for the dental assistant, $2,421, and for the secretaries and receptionists, $2,509. The hygienist received a salary of $4,450 and up in 22.9 per cent of the listings, and only 2.4 per cent of the dental assistants were in this salary bracket.

RESPONSIBILITY FOR DENTAL ASSISTANT TRAINING

A minimum of six years education and training experience is required to produce a dentist and a minimum of two years to train a dental hygienist. To date a person may be classified as a dental assistant without training or experience. The education and training for dentistry involves an expenditure of some $17,000 on the part of the dental student for tuition, books, instruments and living costs and requires two years of predental work and four years in dental school. The two years of education and training for the dental hygienist require some $3,000 for all expenses.[12] These figures do not take into consideration the costs to the dental school or state for buildings, equipment and faculty.

It is amazing how much the dentists have accomplished, as cited in the preceding reports, although the dental assistants generally have had only on-the-job training in the dental office. Perhaps 90 per cent or more of the present day dental assistants have had no formal dental training prior to their first employment. Furthermore, few girls now employed have been screened through available aptitude tests. The American Dental Assistants Association must be given a great deal of credit for developing and activating the 104-hour training program for dental assistants. This program has offered a valuable experience to the assistants as well as to the dentists; however, it does not meet the real needs of the profession in the development of an

10. Bureau of Economic Research and Statistics, American Dental Association. The 1956 survey of dental practice. III. Income of dentists by type of practice, personnel employed and length of work year. J.A.D.A. 54:117 Jan. 1957.

11. Bureau of Economic Research and Statistics, American Dental Association. The 1956 survey of dental practice. IV. Professional expenses; auxiliary personnel. J.A.D.A. 54:284 Feb. 1957.

12. Pelton, W. J., and others. How students finance their dental education. Dental and dental hygiene students: their characteristics, finances and practice plans. Chicago, American Dental Association, 1957.

experienced operating team in a dental office.

It would be important in a manpower study to evaluate what percentage of the assistants presently employed are 40, 50, 75 or, perhaps, 90 per cent efficient in "present day accepted standards of dental assisting." Many hundreds of thousands of hours are lost to the profession annually by the on-the-job method of training by dentists who have never been trained in how to use a dental assistant effectively. Unfortunately, in a few months or perhaps two or five years, this process is repeated because the girl changes her plans. The manpower waste is tremendous.

Assuming that the previous statements and data[8-11] which indicate the increased numbers of patients which can be treated by a dentist with one or two dental assistants, even though the large percentage of the assistants have on-the-job training, are accurate, it is reasonable to conclude that even greater manpower economies could be realized by well-disciplined training of the assistant and of the dentist to work together.

Who should have the responsibility for the training of this very important person, and, equally important, who should have the responsibility for training the dental student or the dentist in how to use the dental assistant effectively? The profession and others interested in the critical dental manpower problem must bring these questions into sharp focus. To date no dental school in the United States can point with significant pride or realism at the solution of the problem of training the dental student in how to use a dental assistant effectively. There certainly can be no serious controversy as to who should assume the responsibility for the training of dental students, the future dentists. If the dental manpower shortage is now critical and if it is to become increasingly critical, then the time is long past due for the dental schools and the profession to determine if the very favorable data submitted by the Bureau of Economic Research and Statistics and the others cited are reasonably valid. The profession then has every reason to find ways and means at the earliest possible date for the large-scale training of dental assistants at the highest possible standard. Furthermore, there must also be found ways and means of adequately training dental students in how to use the dental assistant effectively, otherwise a large percentage of the increased dental manpower potential will be lost. The Council on Dental Education, cognizant of this important deficiency in the training of students of dentistry suggested a change in the dental school curriculum, which was approved by the House of Delegates of the American Dental Association in 1956.[13]

TRAINING OF DENTAL ASSISTANTS AND NUMBER NEEDED

The Council on Dental Education in a recent workshop in Chicago (October 1957) began to approach this important question. Likewise, the Dental Resources Division of the U. S. Public Health Service has directed its attention to the evaluation and training of this source of dental manpower, and, accordingly, it is supporting financially a number of schools of dentistry in studies applicable to the problem.

To date opinions vary widely as to what knowledge and skills a dental assistant should have for the best interests of the profession. Some in the profession would encourage chair-side assisting only, whereas others would extend the assistant's knowledge and skills to include many additional activities. Formal training, in the few schools in which it is now available, varies from the two year curriculum to the 10 week concentrated schedule in the Armed Forces. The

13. Report of the Council on Dental Education [American Dental Association]. Proc., Am. A. D. Schools 34:61, 1957.

Armed Forces do a very creditable job in their short intensive training schedule.

Several important questions should be answered; namely, (1) what are the basic areas of knowledge and skills, which are expected by the profession's present day philosophy of practice and (2) what is the most practical and economical way of making such auxiliary personnel available? The Bureau of Economic Research and Statistics in mid-1955 showed that 22.9 per cent of the dentists had no employees and only 69.5 per cent had full-time assistants. Recognizing that 78,000 dentists were engaged in private practice (1955), the data would indicate that about 23,790 dentists did not have a full-time assistant and that some 17,860 did not have any employees. Assuming that the data presented by the Bureau are reasonably correct and that the dentist has a greatly increased potential for dental service with two dental assistants, the immediate training needs would be for approximately 100,000 assistants.

Can the profession logically endorse a two year education and training experience for the average assistant, as is now required for the hygienist, considering the vast number of assistants now needed, the costs of such training and the high percentage of annual loss of such employees? The answer is obvious, if the profession plans to approach the manpower problem in a practical and economical way.

The program of procurement of qualified high school graduates also presents an interesting challenge to the profession. The number of families that can afford a 3, 6, or a 12 month training experience for a daughter is far larger than the number of those who are financially able to send a daughter to school for two years. The number of qualified applications annually for the dental hygiene programs (approximately 3,000) warrants the conclusion that the dental manpower problem cannot be successfully approached at this time with auxiliary personnel for which two years of formal training are required.

Another interesting and important factor relates to the question of how many of the 24,000 dentists who now do not employ a part-time or a full-time dental assistant would employ one or two full-time assistants if well-trained girls were available. Furthermore, how many of the 54,600 dentists (69.5 per cent) who now have a full-time assistant would employ another assistant? In other words, perhaps the profession needs 100,000 additional dental assistants now, but what is the potential effective demand for such trained personnel? Is the dentist ready to pay for the services of a well-trained assistant, thereby conserving hundreds of thousands of wasted hours each year, and is the training of the dentists in how to use an assistant effectively one of the immediate and great problems? In my opinion, the real problem lies in the lack of training or appreciation on the part of the dentists. When the dental profession is "sold" on the economy (greater patient service) to be realized by the greater use of the assistant then and then only will practical and adequate ways and means be found to produce well-trained dental assistants.

SUMMARY AND CONCLUSIONS

Manpower in dentistry, with its many attendant problems and questions, is an immediate and long-range challenge to every dentist and dental society, as well as to those in the field of dental education and to legislative assemblies. The profession must determine whether to provide dental manpower for the population in terms of need or effective demand and, furthermore, must determine what sources of manpower are to be developed. Every effort should be expended by the profession to make preventive dentistry an effective weapon in the reduction of total dental needs, thereby reducing the total number of dentists required.

The wasted manpower in dentistry is tremendous, perhaps as much as 35 to 50 per cent. The dentist should be trained in the effective use of the dental assistant, and programs should be instituted to provide the necessary number of well-trained dental assistants. The adequate utilization of the dental hygienist and the laboratory technician would further increase the dentist's potential to render dental service.

The optimum or desired national dentist-population ratio is not known today, and there is considerable evidence that a favorable ratio in a given state may vary a great deal from that which would be favorable in other states. Considering the potential roles of preventive dentistry for increasing the utilization of the dentist's skills and knowledge, which now are dissipated in a large measure, and of a more efficient operating environment, with reference to office space and equipment, a favorable national dentist-population ratio at the level of the present economy perhaps could be 1:2,500 or 1:3,000. Dental schools obviously cannot assume the major responsibility for the education and training of the great number of assistants needed. The dental schools, however, are obligated to find ways and means of adequately training the dental student in how to use a well-trained dental assistant effectively.

Etiology of the Cell • It is not possible to look on an elementary granule, globule, or fiber as the starting point of histologic development. There is no reason to suppose that living elements arise from unorganized parts, any more than it can be assumed that certain substances, liquids, plastic elements, matter or blastema give rise to the formation of cells. The formative material are to be found within the cell, they are neither extracellular nor precellular.

Such are the observations which seem to constitute the starting point for any biologic theory. A single elementary form makes up the living organism and remains ever constant. This brings science to a consideration of the higher formations, the plant and the animal, as the sum of the greater or lesser number of similar or dissimilar cells each possessing all the characteristics necessary to life. It is not, however, in a point of superior organization, in man's brain for instance, that the character of vital unity is to be found, but rather in the regular and constant coordination of isolated elements. The individual, therefore, is the result of a type of social organization, an agglomeration of individual existences dependent one on the other. But this dependence is of such nature that each element has its own special type of activity and even when other elements produce some motivations on it, some impulse or excitation whatever they may happen to be, the function does not emanate the less from the element itself. *Rudolf Virchow, Cellular Pathology.*

Cases and Comments

OSSIFYING FIBROMA OF THE MAXILLA

By Marvin E. Pizer, D.D.S., M.S., Alexandria, Va.

Considerable controversy exists as to the correct designation for "ossifying fibroma." Most authors, however, classify this lesion as a neoplasm, regardless of whether it is referred to as a giant cell epulis, a fibro-osteoma or a fibrous osteoma. Knabe[1] says that "ossifying fibroma" of the mandible is probably the monostotic form of fibrous dysplasia.

The pathologic condition is believed to be a tumor containing fibrous tissue which has replaced bone marrow. Later, new bone is formed in an attempt to fill in old regions of resorbed bone.

The disease is said to be more common in middle-aged women. Some authors consider trauma as a etiologic factor, and this tumor is sometimes related to hyperparathyroidism.[2] The tumor with its slow expansion may produce facial deformity. Sometimes the extensive growth of the tumor will interfere with the function of a structure, such as the obliteration of the maxillary sinus. The complete absence of any symptom of pain is a characteristic.

Treatment consists of excision, provided the tumor is small and circumscribed and can be removed completely. Thoma[3] does not feel that it is necessary or advisable to remove an extensive tumor completely, if the operation would be mutilating. Conservative reduction of the tumor to restore facial contour is considered adequate. Some authors have recommended irradiation as a treatment for this tumor.

The prognosis in instances of ossifying fibroma is usually favorable even though recurrences are seen. This tumor has not been known to undergo malignant transformation. The prognosis is even better if the patient has reached an age at which natural skeletal growth has ceased.[3]

The patient in the case to be presented was a 38 year old white woman who was referred to me by her local dentist because of a mass in the mucobuccal fold in the left maxilla that extended from the canine fossa to the second molar region. This protruding mass first was detected by the patient six weeks before the examination, when insertion of her maxillary denture became difficult.

1. Knabe, G. W., Jr. Fibrous dysplasia of the mandible. Report of two cases. Oral Surg., Oral Med. & Oral Path. 10:285 March 1957.

2. Bernier, J. L. Manual for the differential diagnosis of oral lesions. St. Louis, C. V. Mosby, 1942, p. 117.

3. Thoma, Kurt H. Oral surgery. St. Louis, C. V. Mosby, 1948, vol. 2, p. 1243.

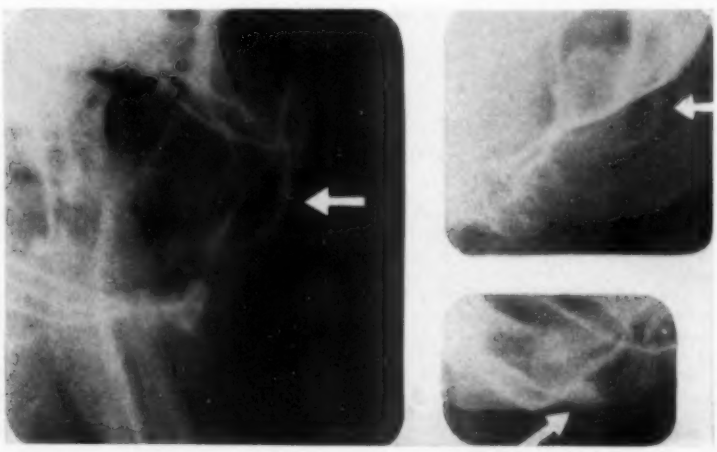

Fig. 1 • Preoperative views of well-circumscribed tumor in canine fossa and maxillary sinus. Left: Lateral view. Above right: Occlusal view revealing extent of involvement of antrum. Below right: Periapical view showing varying degrees of bone density

The patient was admitted to the hospital on April 22, 1956. A complete physical examination and blood and urine studies, with blood studies for hyperparathyroidism, revealed normal findings, and the submaxillary, submental and cervical nodes were not palpable. Oral examination revealed an edentulous mouth, and the soft tissues were normal in appearance except for the tumor. The mass was not tender to palpation and was not freely movable or indurated. Roentgenographic examination of the left maxilla revealed a spherical mass 2 cm. in diameter, located at the inferior margin of the canine fossa and projecting anteriorly and posteriorly into the antrum. On the roentgenograms, the lesion was sharply outlined and showed varying degrees of bone density (Fig. 1).

On April 23, with the patient under endotracheal anesthesia with thiopental sodium, surgical excision of the tumor was accomplished. A mucoperiosteal flap was reflected from the lateral incisor region to the tuberosity of the left maxilla. The very thin cortical bone which had expanded was removed with rongeur forceps. The tumor when exposed was found to involve mainly the antrum and a small portion of the canine fossa. With a mallet and osteotome, a wide section containing the tumor was excised. The walls of the defect were smoothed with bone files, and the wound was closed with no. 000 silk interrupted sutures. A gauze pressure pack was placed, and the patient left the operating room in good condition.

Postoperatively, there was essentially no facial edema. The patient had no fever and was without complaints. On April 25, the patient was discharged from the hospital. All sutures were removed on May 5. The wound had healed by primary intention, and the patient was asymptomatic.

Macroscopic examination of the specimen revealed a hard, granular, gritty encapsulated mass measuring 2½ by 2 by 2 cm. The cut surface was grayish brown in color and trabeculated with irregular reddish areas. Microscopic examination revealed that the tumor was a benign neoplasm containing a dense, fibrous stroma and numerous irregular cells, round to polygonal in shape with a few elongated cells, with fairly hyperchromic nuclei. Numerous large multinucleated giant cells were present. The nuclei were central in position and were up to 15 in number. The stroma in some areas had a chondromyxoid appearance. These findings were compatible with the clinical diagnosis of ossifying fibroma.

Fig. 2 • Occlusal view approximately one year after operation showing only minimal defect on anterior wall of left maxillary sinus

Roentgenographic and clinical examination on April 2, 1957, approximately one year after the operation, revealed complete healing of the oral cavity and no evidence of recurrence in the left maxilla. A small area where the anterior wall of the left antrum had not completely filled in was visible roentgenographically (Fig. 2).

The case of a patient with a pathologic entity that was found clinically and roentgenographically to be compatible with a diagnosis of ossifying fibroma has been presented. The tumor was painless and was noticed only because the location of the mass prevented the insertion of the maxillary denture.

The tumor was accessible by an intraoral approach, and complete excision was accomplished. Healing by primary intention was essential in order to prevent the formation of an oroantral fistula. If the antrum had become infected, a nasoantral window for drainage would have been indicated.

There had been no recurrence of the condition one year after the operation. The prognosis for the patient is excellent since complete excision of the tumor was possible and because natural skeletal growth had ceased.

Hunting Towers, East 131

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Editorials

Science Fairs: an opportunity to interest American youth in dental science

March, it appears, has become the month in which young America starts on its long march toward scientific achievement. It is during this month that embryo scientists display for the first time at local science fairs the scientific exhibits and other creations on which they have labored during the past school year. Winners at the local science fairs will be eligible to exhibit later at regional science fairs. The successful participants at the regional fairs will have the opportunity of participating in the Ninth National Science Fair to be held in Flint, Michigan, May 7 to 10.

The science fair movement is one of the most important of the many movements recently created to increase the interest of American youth in science. Dentists, as well as members of the allied health professions, will do well to encourage these youngsters by giving them moral and material support.

Last November at the ninety-eighth annual session of the American Dental Association the House of Delegates unanimously approved support of the National Science Fair program by adopting the following resolution submitted by the Reference Committee on Dental Research and Therapeutics:

> The Committee believes that active support of the science fair movement is most desirable if not essential to the successful consummation of the Association's research and education programs over the coming years. The science fair movement appears to provide a ready and available mechanism for the development on a national scale of keener recognition on the part of the public of the scientific aspects of the dental profession. It can be a further means of demonstrating the great opportunities that exist for scientific advancement within the framework of a career in dental science and dental practice. The formulation of science fair activities at the local community level is certain to stimulate favorable public attitudes and should measurably

enhance the effectiveness of the Association's efforts in obtaining federal and other support for research grants, fellowships, research facilities under the terms of the Health Research Facilities Act, and an independent building for the National Institute of Dental Research at Bethesda. Moreover, through the science fairs the Association can attract to the dental profession more and more of the brilliant young people who up to now have been lost to other scientific professions where public awareness and interest have been stimulated systematically over the years.

Dentistry offers a wide variety of interesting and educational subjects that not only can be developed into exhibits worthy of display at science fairs but which will stimulate interest on the part of some of the more gifted pupils to the extent that they will enter the dental profession.

In these days of keen competition for recruits in the various occupations, dentistry must take steps to assure that its ranks will be filled from the reservoir of enterprising youngsters who demonstrate unusual ability and interest by participating in secondary school science fairs. Applied science and technology are receiving spectacular prominence as the result of the satellite and missile programs. In their desire to project man into outer space it is essential that scientists and educators keep their own feet on the ground. Advances in intercontinental and interplanetary technology will be of little practical use unless they are paralleled by progress in the health fields.

In nine short years the Science Fair program has proved itself to be a wonderful contribution to science education. Every dentist can make this contribution even greater by contributing to his local secondary school science program. He can do this in one of several ways. He can stimulate the interest of some of his high school age patients in dental science; he can work with the director of his local high school science department or he can volunteer to serve as a science fair judge. Whatever the means and whatever the mechanism, all dentists are urged to take an active interest in Science Fairs. Of the increasing number of young men and women who are being motivated to turn to some segment of science for a livelihood, an increasing number can be favorably motivated to select dentistry as a life work.

Relax, live longer, and more usefully

Although dentists live longer than nondentists, beginning at age 50 the percentage of dentists dying from circulatory diseases is considerably higher than that of the white male population.[1] One cause of circulatory disturbances is nervous tension—the inability to relax. If dentists are to live longer and if they are to live fuller lives they must learn how to relax. That is the gist of the advice which Theodore R. Van Dellen, health editor of the *Chicago Tribune* and assistant dean of the Northwestern University Medical School, gave to the last annual homecoming of the alumni of the Northwestern University Dental School.[2] The advice is sound and it merits a wider audience than that which originally received it.

Dentists, advises Dr. Van Dellen, should adopt recreation of the "doer" rather than the "viewer" type. He urges the dentist to develop "nature's built-in tranquilizer," physiological rest, or calmness of the nervous system.

"Failure to relax has many bad effects on the body," cautions the health editor. "It is responsible for the fatigue and emotional states that disrupt the gastrointestinal system. . . . It also leads to cardiovascular disorders, such as high blood pressure and coronary artery diseases.

"Much depends on the dentist's outlook and philosophy of life. Those who know their limitations and know where they are going are able to do the job with a minimum of fatigue. They have and show a zest for life and are calm. They have not built all their relaxation around alcohol, nor succumbed to the almighty dollar."

The health editor's advice is well intended and it should be well taken. No one knows better than the dentist the nervous tension under which he labors. This tension, however, is much more evident in some offices than in others—the reason being that some dentists, like some people in other occupations, never learn to lead an orderly life. Younger dentists will do well to look about them at the older dentists in their community, practitioners with 40 or 50 years of splendid service behind them. Such men were either gifted by nature with an even temperament or they learned to relax as they lived. To enjoy a long life and a useful one, avoid two of man's greatest enemies—exhaustion and nervous tension.

1. Bureau of Economic Research and Statistics. Mortality of dentists, 1951-1954. J.A.D.A. 52:65 Jan. 1956.
2. Dentists told to relax by Dr. Van Dellen. Chicago Tribune April 25, 1957, p. 5.

Wake up and read

March 16 to 22 has been designated by the National Book Committee as National Library Week—a commendable program designed to focus attention on words and reading for at least one week out of the year.

The United States could not exist without the written word. Take it away and the country could not operate. Without words very little work could be carried on or very little knowledge transmitted. Yet, as a nation, we appear to be losing the habit of reading. A Gallup poll of 1955 indicated that 61 per cent of American adults had read no book except the Bible the previous year. Another survey showed that half the nation's adults live within a mile of a public library but only one fifth of them go inside.

"Certainly," points out Marchette Chute[1] writing for the National Book Committee, "the people of the United States have plenty of time for reading. The work week has been cut from 60 hours to 40, electrical appliances have replaced much manual labor, the life span has been lengthened and leisure made more abundant. The opportunity for reading exists but apparently America is forgetting how to use it."

Dentists are sometimes criticized because of their indifferent reading habits. According to the Gallup studies of 1955, however, these habits are no worse than the reading habits of those in other professions or other occupations. Dentists dare not use that classification, however, as an excuse. As a professional man with a scientific background, the modern dentist can be satisfied with nothing less than a position of leadership in his community. To be a leader means to be informed. To be informed means to be well read. The habit of reading is not only vital to a democratic society but a source of enrichment to the individual himself. Those who read have the most successful careers. America and the American dental profession cannot afford a profession of lazy minds. We salute the National Book Committee, its National Library Week and its slogan, "Wake Up and Read."

1. Chute, Marchette. The aims of National Library Week. New York Doubleday & Co. Inc., December 30, 1957.

International Correspondence

NEWS FROM GREAT BRITAIN

The sixth session of the General Dental Council opened with an address by the president, Sir Wilfred Fish. In the address Sir Wilfred mentioned the following matters that are of interest:

The Council has recognized certain diplomas conferred by universities in Australia, New Zealand, South Africa, Malaya and Malta as entitling those who hold them to registration in the Commonwealth list in the Dentists Register, in accordance with the provisions of section 12 of the Dentists Act of 1957.

The education committee had no doubt that they would be acting in accordance with the wishes of the Council in extending concessions to the handful of Hungarian dentists who have sought asylum in Great Britain after the Hungarian revolution. They will be given an opportunity to take examinations modified to take into account the time that has elapsed since they qualified. In the meantime nearly all of them have found appointments and have been accorded temporary registration under section 13 of the Dentists Act.

The Ancillary Dental Workers Regulations, which the Council approved in final draft in March of last year, have now come into force. It is unusual for an independent body such as the Council to be given powers to make regulations by statutory instrument, and it can be surmised that Parliament intended to place the responsibility for making these regulations squarely on the Council's shoulders while retaining close supervision over the form they should take. The regulations, while making general provision for the enrollment, training and disciplining of any class of auxiliary dental workers which may be set up, actually provide for the establishment of only one class, dental hygienists.

During the past three months more than a hundred names have been entered in the new roll of dental hygienists and a large number of inquiries have been received from women and some men who are anxious to start training in this work. It will be recalled, however, that the Council has no responsibility for making arrangements for training hygienists, although it has a duty to set out recommendations concerning the minimum course of study and examinations to be taken by candidates for inclusion in the roll, similar in form to the recommendations concerning the dental curriculum.

The Privy Council, having first consulted this Council, has now required the Council to institute the experimental scheme for the training and employment of dental auxiliary personnel as quickly as possible. This duty is to be performed by the special committee whose constitution is prescribed in the Dentists Act.

The survey of the legal and educational requirements for the practice of dentistry and dental surgery in different parts of the world which has been in preparation in the Council's office for some considerable time has now been published in summary form under the title "Regulation of Dental Practice." Much of the information about 180 countries and provinces overseas which is needed for day-to-day work and which should be of value for purposes of reference to a number of other authorities is included. The Council is grateful for the valuable assistance which has been received from the Fédération Dentaire Internationale in the preparation of this book and in particular in the task of obtaining the information from which it has been compiled.

BRITISH DENTAL ASSOCIATION

It may interest readers to know of the main provisions of the agreements currently operating for the employment of dental technicians and apprentices. The agreements are negotiated by the National Joint Council in which the British Dental Association and the Surgical Instrument Manufacturers Association are represented on the employers side and representatives of the unions representing dental technicians on the employees side.

There are now only two recognized grades for adult technicians:

Grade 1. The dental technician who, in addition to being a good all-round craftsman, is a specialist in and is able to carry out crown and bridge technic of an advanced nature, advanced orthodontic work, or the construction of surgical appliances or advanced ceramics.

Grade 2. The all-round dental technician who has completed five years' apprenticeship or who is able to undertake the ordinary

processes in a dental laboratory without direct supervision.

The agreed working hours are 44 per week. After this time an overtime rate of time and a quarter applies. Double time is payable for work on Sundays, bank holidays and statutory holidays.

From the beginning of the first full pay period after May 31, 1957, the minimum weekly wage of a Grade 1 technician became £11.5s. a week and that of a Grade 2 technician became £9.10s. a week.

The weekly rates for apprentices after the same date were: First year, £2.7.6d.; second year, £2.17.6d.; third year, £3.16.0d.; fourth year, £4.15.0d.; and fifth year, £6.3.6d.

There are also provisions for vacations with pay and for sick pay.

BRITISH DENTAL JOURNAL

The first issue of the *British Dental Journal* for 1958 has a rearranged text so that the section containing the leading article, letters, general articles and reviews of books is placed before the original communications. The chief reasons for this change are that it separates the pages which are mainly opinion from those which are news and allows the economical use, on occasion, of improved paper for illustrations. In addition, this arrangement will make it easier for those who wish to bind only that part of the *Journal* which contains original articles.

PUBLIC DENTAL SERVICE

Reports of two principal dental officers contain very significant statements on the incidence of dental disease among school children.

Mr. J. Fletcher, principal dental officer in the County of Devon, states in his report that the incidence of dental disease is becoming manifestly worse from year to year. For example in Devon in 1950 there were 95 fillings in permanent teeth per 100 children. In 1956 this figure rose to 165. Extractions of permanent teeth rose from 13.2 in 1950 to 27 in 1956.

Mr. L. J. Threlfall, principal school dental officer to the city of Portsmouth writes that "It is particularly distressing to see the children, who, during the years of war stringencies, had developed good dentitions, now, owing to habits recently acquired, showing extensive evidence of dental disease." In many cases the rate of deterioration is extremely rapid. If the habits so acquired and which are well known are continued, Mr. Threlfall feels that it will be inevitable that in a short time the function of the school dental service will be solely the relief of pain, and conservative treatment will have to be abandoned.

ITEMS OF INTEREST

In the early part of January the Birmingham Dental Hospital was 100 years old. It was not the first such hospital to be opened, being preceded by the Institution for the Diseases of the Teeth founded by James Snell, Sir Edwin Saunders and W. A. Harrison in 1840 and the London Dental Hospital founded by C. J. Fox in 1855. It is now, however, the oldest dental hospital in operation in the British Isles and probably in the world. The founder was Samuel Adams Parker, a pupil of Sir John Tommes and son of a well-known Birmingham surgeon.

The Eastman Dental Hospital has recently received a gift of £5,000 through the public trustees from the estate of the late William Shepherd. This gift will be used for the furtherance of dental research at the postgraduate school which at the moment has no endowment and is financed by the Ministry of Health and the University of London. Because the Ministry of Health and the universities are now responsible for the provision of dental education, many people believe that the money the schools receive is sufficient for all they wish to do. This, of course, is not the case.

In the December 17, 1957, issue of the *British Dental Journal* appears a very interesting and valuable article by C. H. Rubra on Dental Care of Children in Western Europe. The conclusions drawn from this study are stated briefly as follows: "There are not enough dentists taking care of children. This is due to economic difficulties, which are not insuperable, and to defects in dental education, for which the remedy lies in the hands of the dental schools."

The many friends and colleagues of Miss Jean Forrest, senior dental officer to the Ministry of Health, will wish to congratulate her on her election to Honorary Fellowship in the Royal Society of Health for her noteworthy work in connection with the promotion of health.

G. H. Leatherman,
D.M.D., F.D.S., R.C.S., F.A.C.D.

NEWS FROM THE REPUBLIC OF ARGENTINA

The Assembly of University Counselors, composed of eight professors, four students and three graduates, has elected Dr. Risieri Frondizi president of the University of Buenos Aires. Dr. Frondizi is the dean of the School of Philosophy and Letters.

The other deans are: College of Medicine, Dr. Florencio Escardó; College of Law, Dr. Aquiles Guaglianone; College of Engineering, A. C. Constantini; College of Exact Sciences, Dr. R. V. Garcia; College of Architecture, A. C. Casares; College of Economic Sciences, Dr. J. Punturo; College of Agriculture and Veterinary Medicine, L. Foulón; and College of Pharmacy and Biochemistry, Dr. Z. M. Lugones.

Because the College of Dentistry has not yet completed its reorganization for the appointment of full professors, it is unable to take part in the University Assembly. Efforts are being accelerated to resolve this situation.

The three part government of professors, students and graduates is perhaps not too well understood in the United States, but, considering the origin of the universities in the Republic, which is quite different, it may be understood that this method represents a just solution for many problems encountered in the past. It is still hoped that the universities can arrive at the same point as the universities of the United States by this different road.

The students and graduates do not accept the professorial majority. They wish, in addition to the tripartý plan, to have an equal voice; that is, that the numerical division of the three groups be equal.

They also wish the duration of a contract for a full professor to be five years, with a requirement that he be reconsidered at the end of this period. He may be re-elected. For the most part, full-time "appointments" are continuing. In general, they are working to keep university teaching entirely on a state level. Many believe that it should be free.

GROUP IN JUJUY NAMES OFFICERS

The officers of the Círculo Odontológico de Jujuy, located in one of the northern provinces of the Republic, are: president, Héctor S. Bustamante; secretary, Nestor Manaur; treasurer, Avelardo López; and member, Julio Obelar.

DENTAL PREPARATORY COURSE

A preparatory course for students wishing to enroll for 1958 in the College of Dentistry of the University of Buenos Aires is being developed.

In this month long course, the faculty attempts through various methods to familiarize the students with all aspects of a dental career. Thus, the student will be spared false concepts which would bring him into a profession for which he is temperamentally unsuited and to which he would not become adapted.

Attention is called to the fact that this year 75 per cent of the students are women.

In this preparatory course, the role of the sciences in dentistry is explained, for instance, the place of biology, physics and chemistry. This is done so that the student may understand the significance and importance of his courses. There is an additional course in materials used in dentistry. The students also prepare carvings of ordinary objects but do not work on teeth or with prosthetic materials. They have accepted this course willingly although it is given during the vacation period.

Ricardo Augusto Crespi,
correspondent from Buenos Aires

Association Affairs

COUNCIL ON LEGISLATION TESTIFIES IN HEARING

Several matters affecting dentistry are under consideration by the 85th Congress. The Council on Legislation is prepared to represent the Association in several hearings, according to Bernard J. Conway, secretary of the Council.

Jenkins-Keogh • Floyd W. Pillars, vice-chairman of the Council, presented the Association's viewpoint on the Jenkins-Keogh bills (H.R. 9 and 10) before a House committee hearing in late January. The bills would encourage professional men to establish pension plans by allowing them to defer tax payments on the money put into a qualified plan until they reach retirement. Dentists were urged to support passage of the bills in an editorial in the February issue of THE JOURNAL.

According to the Council, Senator Sparkman of Alabama is sponsoring a bill in the upper chamber (S. 3194) which includes in its proposals a modified version of the Jenkins-Keogh plan.

Dental Research • As THE JOURNAL went to press, the Council on Legislation was planning to present testimony in late February strongly supporting an appropriation of $3,700,000 for a building for the National Institute of Dental Research. The money for the building was not included in the President's budget, although the plans for the building are to be completed during 1958. Representative Fogarty, who spoke to the Association at the recent annual session in Miami, is chairman of the House Appropriations Subcommittee which will conduct the hearing on the Department of Health, Education and Welfare budget.

The President's budget for the National Institutes of Health was about the same as the budget for 1958—a total of $211,183,000. However, some internal adjustments can be noted. The National Institute of Dental Research is slated to receive $6,293,000 for 1959 as compared with $6,430,000 in 1958. The decrease, however, will not affect the Institute's program, since some money assigned last year to the Dental Institute for general research will be budgeted to the parent agency's program under the 1959 recommendations.

Pay Increase for Federal Dental Officers • A bill (H.R. 6719) that would substantially increase the pay of dental and medical officers in the Veterans Administration was expected to come up for final action before the end of February.

Also, the House Armed Services Committee hearings on pay increases for all military and Public Health Service personnel were begun in February. One of the pay plans, which is supported by the Administration, would mean a significant pay increase for commissioned officers in the higher ranks.

Dental Schools • An administration-supported measure (H.R. 6874) would provide 18 million dollars for three years as matching grants to dental schools for construction of teaching and research facilities.

Two other bills (S. 1922 sponsored by Senator Hill and H.R. 7841 sponsored by Representative Fogarty) would provide 40 million dollars in matching grants

over a five year period to dental schools for construction of teaching and research facilities. The President recommended in his budget that Congress enact legislation enabling the government to assist dental and medical schools.

Medicare • A bill (H.R. 10195) has been introduced in the House to remove the Territory of Hawaii from the definition of an overseas area within the provisions of the Dependents Medical Care act. The bill, which was introduced by Mr. Burns, territorial delegate from Hawaii, at the request of the Hawaii Territorial Dental Society, would place dependents of servicemen stationed in Hawaii in the same status as dependents in the continental United States. Presently dependents in Hawaii are entitled to complete dental care at military facilities. Those in the continental United States may receive complete care only at installations remote from civilian dentists.

COUNCIL ADOPTS REPORT ON DIETARY FLUORIDES

The Council on Dental Therapeutics, meeting at the Central Office February 14 and 15, adopted a report on prescribing supplements of dietary fluorides. The report, which will be submitted for publication in an early issue of THE JOURNAL, was prepared because a number of requests from dentists concerning the administration of supplements of dietary fluoride have been received by the Council.

According to Dr. J. Roy Doty, secretary of the Council, the Council also discussed the problem of severe reactions to penicillin thoroughly and came to the conclusion that no change in Council policy as expressed in the 1958 edition of *Accepted Dental Remedies* was indicated.

Present at the meeting was Dr. Julian Sachs, who was recently appointed to the medical division of the federal Food and Drug Administration and is the only person with the division who has both D.D.S. and M.D. degrees.

Fred A. Henny, editor of the JOURNAL OF ORAL SURGERY and chief of the oral surgery department, Henry Ford Hospital, Detroit, also attended part of the Council meeting.

1958 RELIEF FUND DRIVE TOPPED GOAL ON FEB. 10

The Council on Relief, meeting at the Central Office February 23 and 24, heard that the 1958 drive had gone over the goal with $104,845.18 having been contributed as of February 10.

H. R. Bleier, chairman of the Council, sent a second appeal for contributions to all Association members the last week in January. The response pushed the total over the $100,000 mark set for the drive.

As of February 10, 35 constituent societies and the Public Health Service had exceeded their goals. Tennessee contributed 286.7 per cent of its goal and continued to lead all other societies. Alaska was second with contributions totaling 183.3 per cent. The Public Health Service, with 183.1 per cent contributed, was in third place.

TOPICS ANNOUNCED FOR APRIL DENTAL HEALTH CONFERENCE

Three major subjects will be treated at the Ninth National Dental Health Conference, sponsored annually by the Council on Dental Health and to be held April 28-30 at the Central Office, Jay H. Eshleman, council chairman, announced.

The opening speech of the conference will suggest possible areas of dental practice, such as office design, business procedures and the use of auxiliary personnel, on which studies would be valuable as an aid to increasing efficiency.

The first subject to be considered will be the determination of dental fees. Aspects, such as cost accounting, ethical considerations, the presentation of the fee estimate to the patient and the study of the cost of dental care by state societies, will be discussed.

The second topic will concern the development of the program of the state dental division as a cooperative effort of the division and the state society. Legislative procedures for obtaining federal matching grants earmarked for dental programs will be considered, as well as dental care provided under public assistance programs. The use of a questionnaire which was recently developed by the Council and the American Association of Public Health Dentists as an aid in determining the content and cost of the state dental division's program, will be explained. The questionnaire is designed to be used cooperatively by the division and the state society.

Dental care provided to date under the Medicare program will be reported and will be the third topic of discussion.

Discussion groups will be held on each of the three major topics of the conference.

The Council on Dental Health will meet May 1 and 2 to evaluate the reports from the conference discussion groups and consider policy recommendations.

SPECIAL COMMITTEE ON WASHINGTON OFFICE TO MEET

The Special Committee on the Washington Office will meet after the meeting of the Board of Trustees set for March 10-12.

The special committee of the Board of Trustees will explore the advisability of expanding the facilities of the Association's office in Washington, D. C. Arthur W. Easton of Norway, Maine, trustee from the first district, is chairman of the special committee.

A.D.A. CITED FOR EXHIBITS AT INTERNATIONAL FAIRS

The American Dental Association has received an award from the U. S. Department of Commerce for its participation in overseas trade fairs during 1957.

The citation, signed by Secretary of Commerce Sinclair Weeks, recognized the Association for "contributing significantly to the advance of world understanding of peace and prosperity under the American system of free enterprise." The Association displayed educational materials on dental health at fairs in Italy and Spain during 1957.

ALSTADT URGES DENTISTS TO SUPPORT RED CROSS DRIVE

William R. Alstadt, Association president, urges all dentists to support the 1958 fund and membership campaign of the American National Red Cross.

Dr. Alstadt said:

> The fine work of the Red Cross and its many magnificent contributions to the American people over the last 77 years are well known and appreciated by members of the dental profession.
>
> Realizing that the work of the Red Cross in its disaster relief, Armed Forces and veterans programs, blood donor and safety service is made possible only through funds contributed to its cause, I am urging all members of our profession to support the 1958 campaign.
>
> I am confident that dentists everywhere will respond generously.

NAVAL CASUALTY TREATMENT COURSES OPEN TO DENTISTS

The Council on Federal Dental Services has arranged with Rear Admiral R. W. Malone, chief of the Navy Dental Corps, for a limited number of civilian dentists to attend "Casualty Treatment Training Courses" to be conducted at four naval installations during the year.

The instruction covers treatment of shock, fractures, ballistic wounds, radia-

tion injuries and other related subjects. The courses vary from two days to two weeks in length depending on the length of the daily sessions. Some of the technics are applied in simulated field conditions.

One civilian dentist will be permitted to attend each course at the Naval Dental School in Bethesda, Md., the Naval Dental Clinic at Norfolk, Va., and the San Diego and Great Lakes naval training centers. There will be no charge for the courses, and, at most installations, housing and dining accommodations will be available at a nominal charge. The Council is particularly interested in having dentists attend who will employ the training received to educate the members of their local societies in casualty treatment, said Herbert C. Lassiter, secretary of the Council. Further information can be obtained from Mr. Lassiter at the Central office.

TOPICS FOR INSTITUTE ON HOSPITAL DENTISTRY SET

The subjects that will be discussed at the Second Institute on Hospital Dentistry have been announced. The Institute, which will be held June 2-5 at the Edgewater Beach hotel in Chicago, is sponsored jointly by the American Dental Association, the American Hospital Association and the American Medical Association.

The subjects listed for the June 2 session are "Governing Board's Responsibility for Patient Care," "How the Hospital Functions" and "Needs and Values of a Hospital Dental Service." On the morning of June 3, dental service in hospitals and staffing the dental service will be the topics for panel discussions. A tour of Zoller Dental Clinic of the University of Chicago will be conducted in the afternoon.

A panel discussion on the effects of third party payment plans on hospital dental service will be held June 4, with group discussions following in the afternoon. "A Look Around the Corner—What is Ahead in Hospital Care" will be a topic on the final day of the Institute.

According to Gerard J. Casey, secretary of the Association's Council on Hospital Dental Service, reservation blanks can be obtained by writing the Council at the Central Office or the Institute office, American Hospital Association, 18 E. Division St., Chicago. The fee is $40 a person.

UNIQUE EDUCATION PROGRAMS DISCUSSED AT CONGRESS

Six unique programs in dental education were the subjects of the papers and the discussion at the Fourteenth Congress on Dental Education and Licensure, held February 1 at the Conrad Hilton Hotel, Chicago, under the sponsorship of the Council on Dental Education.

Approximately 250 dental educators, examiners and persons in allied fields attended the Congress. Dr. Shailer Peterson, secretary of the Council, called attention to the notable increase in attendance over that at the 1957 Congress.

During the morning session, Wendell L. Wylie, assistant dean and professor of orthodontics, University of California, read his paper on the school's undergraduate program in orthodontics, which has been in operation 25 years. Dean Roy O. Greep of Harvard School of Dental Medicine, said in his paper on the clinical dental education program at the school that the program "has . . . demonstrated that it is possible to effect a great saving in time required to teach some of the important basic dental technics." Western Reserve University School of Dentistry is currently analyzing its program, said Paul E. Boyle, dean and professor of dental medicine.

During the afternoon session, papers on the programs of three schools were

presented and discussed. J. V. Olson, dean of the University of Texas Dental Branch, pointed out the unique aspects of the school's program. Wendell D. Postle, dean of Ohio State University College of Dentistry, said that, with the increasing need for dentists, some way must be found "to make the tutorial system applicable to mass education," in his paper on the school's family dentist training program. The four quarter plan that has been operating at the College of Dentistry of the University of Tennessee for ten years was discussed by the dean, James T. Ginn. He said the program allows students to complete their studies in three years by continuing through the summer quarters.

The papers and a summary of the discussion are being submitted to THE JOURNAL for possible publication, said Dr. Peterson. He added that the Council has copies of the papers available.

$1,000,000 IN BENEFITS PAID UNDER A.D.A. INSURANCE PLAN

Approximately $1,000,000 in benefits under the American Dental Association's group life insurance plan was paid to beneficiaries of dentists during 1957, according to a year-end statement by the company which administers the plan.

These life insurance proceeds were received by the families or other beneficiaries of 188 Association members. The Great-West Life Assurance Company stated in their report that approximately 19,000 dentists are now enrolled in the A.D.A. group life plan.

SOUTHERN BOARD REPORTS ON DENTAL MANPOWER NEEDS

Findings on the expected increased demand for dental services in the South due to the region's increasing income and population during the next 10 to 20 years and recommendations for providing more dentists and increasing dentist productivity are reported in *Dental Manpower Needs in the South,* the 60 page report on a study conducted by the Southern Regional Education Board, in cooperation with the American Dental Association and the Public Health Service.

The report is available from the board at 881 Peachtree Street, N.E., Atlanta 9, Georgia.

EISENHOWER CITES PROGRESS IN PREVENTIVE DENTISTRY

In connection with the observance of Children's Dental Health Week in February, President Eisenhower cited progress in preventive dentistry, including fluoridation.

The President's statement, made in a telegram to William R. Alstadt, Association president, was as follows:

> As Children's Dental Health Week is observed throughout the nation, it is fitting to note the recent development of measures, including the fluoridation of water supplies, to prevent tooth decay in the early years of growth.
>
> I invite the attention of the public to the study of progress in this field, and I urge all citizens to cooperate in such measures as will lead to the improved dental health of our children and youth.

ALSTADT, CAMALIER ATTEND CONFERENCE ON SECURITY

William R. Alstadt, Association president, and C. Willard Camalier, Association assistant secretary, accepted invitations to attend the National Conference on the Foreign Aspects of United States National Security February 25 in Washington, D. C.

An address by President Eisenhower was on the schedule of a dinner meeting of the conference. Invitations were issued by Eric Johnston, chairman of the International Development Advisory Board of the Department of State.

REPORT SHOWS WIDE RANGE IN CONSTITUENT SOCIETY DUES

The amount of dues for active members of constituent societies ranges from $3 in the Panama Canal Zone to $100 in Alaska, a report issued recently by Louis M. Cruttenden, Association assistant secretary, showed. The median amount of dues was $20.

California, Georgia, Michigan, Minnesota, South Carolina, Tennessee, Vermont and Virginia state societies increased their dues over the amount shown in last year's report. The Illinois State Dental Society also reported an assessment for the year 1958. The average of the amounts of dues ($24.34) reflected the increases, with a gain in the average of the dues of $2.34 over last year.

The California State Dental Association charged the highest dues among the state societies ($52).

BUREAU ISSUES BOOKLETS ON ROENTGENOGRAMS, DENTURES

The Association's Bureau of Dental Health Education has issued two booklets, *X-Rays and Your Teeth* and *Your New Dentures,* according to Perry J. Sandell, director.

The first booklet is designed to educate patients regarding the value of dental roentgenographic examination and to allay their fears about radiation hazards. Illustrations showing how roentgenograms reveal certain dental disorders are used. The booklet is available at the following prices, which include shipping charges: $1.75 for 25, $2.95 for 50 and $4.85 for 100.

Your New Dentures is an aid in educating patients with new dentures about problems which may arise. The need for regular professional supervision is stressed in the recently revised booklet. Prices are $1.30 for 25, $2.25 for 50 and $3.60 for 100.

The booklets are available from the Order Department, American Dental Association, 222 East Superior St., Chicago 11.

Subscripts • John J. Hollister, business manager of the Association, was elected to a second term as secretary of the Professional Convention Management Association at the group's annual meeting in late January. The purpose of the association is to improve management of conventions in medical, dental and allied fields. . . . Arthur W. Easton of Norway, Maine, first district Trustee, was honored recently for his 25 years as president of the Norway National Bank. The bank was founded in 1933.

Dental Societies

NORTH CAROLINA SOCIETY PLANS ANNUAL MEETING

The North Carolina Dental Society will hold its annual meeting May 4-7 at Pinehurst, N. C.

Percy T. Phillips, president-elect of the American Dental Association will address the general session on "The Association's Obligation in Changing Times." Paul L. Chevalier of Richmond, Va., Louis I. Grossman of Philadelphia and L. B. Higley of the University of North Carolina School of Dentistry, Chapel Hill, will also speak.

The headquarters hotel for the meeting will be The Carolina.

THOMAS P. HINMAN CLINIC SET FOR MARCH 16-19

The 46th session of the Thomas P. Hinman Dental Clinic in Atlanta, Ga., will be held March 16-19 in the Atlanta municipal auditorium.

The Clinic, which is open to all den-

tists, is sponsored by the Fifth District Dental Society. Clinicians and their subjects are Dr. Stanley Harris, Chicago, "Use and Abuse of Drugs"; Jasper S. Hunt, M.D., Charlotte, N. C., "Common Problems of Children of Interest to the Dentist-Pediatrician Team"; Aaron A. Moss, Plainfield, N. J., "Hypnodontics, Hypnosis in Dentistry"; John H. Mosteller, Birmingham, Ala., "Amalgam Restorations"; Clawson N. Skinner, Whittier, Calif., "Full and Partial Dentures"; and Bernard Wakefield, Buffalo, N. Y., "Oral Surgery."

Benjamin A. Dyas is chairman for the event.

MINNESOTA ASSOCIATION MARKS 75TH ANNIVERSARY

The annual meeting of the Minnesota State Dental Association, scheduled for April 14-16 in St. Paul, will commemorate the 75th anniversary of the association's founding.

In addition to the scientific program, a diamond jubilee banquet and ball will be held the night of April 14 and a dental office of 75 years ago will be contrasted with a modern office in a special display. *North-West Dentistry,* the association's journal, will publish a special issue containing a history of the association.

Lieut. Gen. Leslie R. Groves, who directed the Manhattan Project which produced the atomic bomb, will speak during the April 15 session in the St. Paul auditorium.

CANDY AD DISCONTINUED AT DENTAL GROUP'S REQUEST

A Chicago food company has complied with a request of the Oklahoma State Dental Association and has discontinued the use of a candy recipe on disposable milk cartons now being manufactured for the company. The association objected to the candy promotion on the ground of the high sugar content called for in the recipe.

L. A. Lucas, association president, praised the cooperativeness of the Beatrice Foods Company and cited the excellent relationship between the dairy industry and the dental profession.

ALSTADT SPEAKS, WEISZ GIVEN AWARD AT CHICAGO MEETING

Association President William R. Alstadt, speaking before the general session of the annual Midwinter Meeting sponsored by the Chicago Dental Society in February, urged increased dental service for "the mentally and physically handicapped" and further emphasis on other measures for prevention of caries in addition to fluoridation.

Dr. Alstadt said that "one of the great problems that must not be overlooked is that of bringing an essential health service to those who could be called 'dental orphans.' Much progress has been made but much more remains to be accomplished in this field." He stressed dental services for chronically ill persons whether they are confined to their homes or in hospitals or other institutions.

Walter S. Weisz was presented the Society's annual $500 research award by Walter E. Dundon, Society president, for his 10 year study on the effectiveness of a sodium fluoride mouthwash in reducing the incidence of dental caries. Dr. Weisz, a pedodontist in private practice in Philadelphia, reported a significant reduction in the number of DMF surfaces in the group of children who used the mouthwash as compared with the control group.

Over 15,000 dentists and representatives of allied fields registered for the 93rd Midwinter Meeting February 2-5 at the Conrad Hilton Hotel in Chicago.

During the general session, Dr. Dundon also reported that $1,705,000 of dental work had been financed through the Society's postpayment budget plan since

At the Workshop on Dental Health of the Missouri State Dental Association were (l. to r.): B. J. Conway, secretary of the A.D.A. Council on Legislation; H. H. Mehaffey, state division of health; W. W. White, member, state council on dental health; B. B. Hamilton, president, Missouri association; E. S. Khalifah, editor, The Journal of the Missouri State Dental Association; and J. V. Kirby, member, A.D.A. Council on Dental Health.

Proclamation of Children's Dental Health Week, February 2-8, was made by New York City Mayor Robert F. Wagner. He also awarded banners to schools having 100 per cent completion of dental care of their students. (L. to r.) Marilyn Ferrand, 10; Arthur Bushel, director, bureau of dentistry, New York City Department of Health; Mayor Wagner; Mrs. Marianne Faeber, Department of Health dental hygienist; M. J. Freedman, general chairman for Children's Dental Health Week; and David Schwartz, 13.

Twenty-five of the 33 living past-presidents of the Detroit District Dental Society gathered during the group's annual dental review last year. They are (l. to r., top row) C. W. Harling, F. G. McGuigan, P. J. Ross, H. Green, W. S. Anderson, A. C. Sawicki, (middle row) O. C. Applegate, R. G. Hayward, R. L. Girardot, R. W. Walmoth, A. H. Lowther, M. H. Miars, C. H. Jamieson, G. M. Peterson, N. D. Gotschall, D. Seligson, S. P. Jesson, A. V. Diedrich, M. A. Leitch, (seated) S. Becker, O. W. White, E. B. Spalding, L. N. Hogarth, G. C. Richardson and B. R. East. The six men seated have been in practice 50 years or more.

it went into operation April 1, 1955. "The Profession and the Practice of Freedom" was the subject of an address by Clarence E. Manion, former dean of the School of Law, Notre Dame University, during the session.

Wayne L. Fisher was general chairman for the meeting, and Graham O. Davies was program chairman.

WISCONSIN ANNUAL MEETING SET FOR APRIL 21-23

The 88th annual meeting of the Wisconsin State Dental Society has been set for April 21-23 in Milwaukee. William R. Alstadt, president of the American Dental Association, will address the group on the opening day's program.

The program will feature ten study courses in addition to table clinics and motion pictures. Twelve essayists will speak during the three day meeting. Further information can be obtained from the society's executive secretary, Kenneth F. Crane, 704 W. Wisconsin Ave., Milwaukee.

Subscripts • Joseph P. Thiriot of Chickasha, Okla., has been named executive secretary of the Louisiana Dental Association. He was formerly with Chickasha Milling Company. . . . The Tennessee State Dental Association moved to new offices at 119 Louise Ave., Nashville, in late December. . . . One issue of the *Washington State Dental Journal* and 11 issues of the group's *Newsletter* will be published during 1958.

International

ALSTADT TO REPRESENT A.D.A. AND F.D.I. AT ASIAN CONGRESS

William R. Alstadt, Association president, will represent the American Dental Association and the Fédération Dentaire Internationale at the Second Asian Dental Congress and Asian-Pacific Dental Conference to be held in Manila March 24-30. Dr. Alstadt is also scheduled to speak to the groups.

BRITISH SEALS FOR RELIEF INSPIRED BY A.D.A. PROGRAM

The practice of using seals to aid in collecting funds for the relief of dentists has spread to Great Britain. The British Dental Association Benevolent Fund has used seals for the past three years, with the result that the amount and number of grants available to dentists and their families has been increased substantially, according to W. R. Cleverley of Coventry, England, Benevolent Fund secretary of the British Dental Association.

Mr. Cleverley attributes the idea to the successful example of the American Dental Association Relief Fund. Mr. Cleverley instituted the use of seals in the 1955 drive for the Fund.

The Benevolent Fund has been in operation 50 years. It is outside the jurisdiction of the British Dental Association and is run by a voluntary committee.

LUEJE ELECTED PRESIDENT OF ARGENTINE ASSOCIATION

José Manuel Lueje was elected president of the Asociación Odontológica Argentina.

Other officers include Raul Otaño Antier, vice-president; Julio C. Barrancos Mooney, secretary, Hernán M. Echeni-

que, Jr., assistant secretary; Carlos Waissbein, treasurer; and Diego R. Pérez Espinosa, assistant treasurer. Ernesto Rossi is president of the board, and Carlos A. Fontan is board secretary.

DENTAL ANESTHESIA SOCIETY FOUNDED IN ENGLAND

The Society for the Advancement of Anaesthesia in Dentistry, a newly formed group in England, now is issuing digest reports of its meetings which are available to associate members. The Society is also forming advisory panels on anesthesia and equipment that will transmit information to members on request.

Dentists or anesthetists who are interested may contact the Society at 53 Wimpole St., London.

AMERICAN DENTAL CLUB OF PARIS ASKS FOR SPEAKERS

Dentists from the United States who would serve as essayists or present table clinics at meetings of the American Dental Club of Paris are asked to write Jean P. Roger, club president.

The club meets the first Thursday of each month from October through June and is composed largely of dentists who have studied in American schools. All meetings are conducted in English.

Interested dentists may write Dr. Roger at 174 Boulevard Haussmann, Paris, France.

BRAZILIAN ORGANIZATION APPOINTS OFFICERS

Recent appointments to the board of directors of the Sindicato dos Odontologistas do Paraná, Brazil, include Ciro Rausis, Odilon Peixoto de Mattos, Rubens da Costa Straube, Jair Lima Gevaerd and João Américo de Oliveira, Jr. Alternates are Dilzo Bellin Faraco, Luiz Russo, Alaor Jason Brenner, Hipólito Alves de Araujo, Fileto Lima and Narcizo José Grein.

Three members and three alternates also were appointed to the financial board. Those selected are Orlando Filizola, Amaury Gabriel Mattei and Adalberto Walter Denck, members, and Júlio Cézar Gomes, Nael Evangelista de Almeida and Nelson Crivellaro, alternates.

SIMON, GERMAN ORTHODONTIST, DIES AT AGE 75

Prof. Paul W. Simon, a well-known German orthodontist, died in October at the age of 75.

Prof. Simon taught at the University of Berlin, was editor of the *Journal of Dental Orthopedics* and past president of the European Orthodontological Society and the German Society for Orthodontics.

He was the author of several textbooks that have been translated into English and of many articles that have appeared in American journals. He gave several lectures in the United States between 1924 and 1926.

ARPA INTERNATIONALE TO AWARD JACCARD PRIZE

The Dr. h. c. René Jaccard Prize will be awarded for the second time during the 15th Congress of the Association pour les Récherches sur les Parodontopathies (ARPA Internationale) in Paris July 7-12.

Candidates for the prize must present an original paper published or report of treatment performed between 1956 and 1958 and need not be members of the organization.

Six copies of papers should be sent by registered mail before May 15 to Prof. A. J. Held, Institut de médecine dentaire, 30 rue Lombard, Geneva, Switzerland.

Dental Education

SUPPLY COMPANY AWARDS $600 TO EACH OF 13 SCHOOLS

Grants of $600 for research or graduate work were made to 13 schools by the M. F. Patterson Dental Supply Company. The gifts, totaling $7,800 and to be known as the Patterson-Hettinger-Cary fellowships, were announced at Christmas by the company's president, W. O. Patterson. Recipients were the dental schools of the State University of Iowa, Loyola University in New Orleans, University of Minnesota, Marquette University, University of Kansas, Creighton University, University of Nebraska, University of Oregon, Meharry Medical College, University of Tennessee, Baylor University, University of Texas, and University of Washington.

BRUDEVOLD APPOINTED PROFESSOR AT HARVARD

Finn Brudevold has been appointed professor of dental medicine at Harvard School of Dental Medicine and chief of dental medicine at the Forsyth Dental Infirmary, Boston. His appointment will be effective August 1.

Dr. Brudevold is presently director of dental research at the Eastman Dental Dispensary and assistant professor of dental research at the University of Rochester. He is a native of Norway, and he received his L.S.D. degree from the State Dental School, Oslo, Norway.

GRADUATE FELLOWSHIPS AVAILABLE AT ROCHESTER

The University of Rochester School of Medicine and Dentistry has announced that a number of fellowships are now available to dental graduates who are interested in research and additional training in the sciences fundamental to dentistry and in preparation for an academic career.

Programs lead to the degrees M.S. and Ph.D. A program leading to the M.S. degree with a major in dental science is also available. This program may be combined with clinical training. Remuneration varies between $3,000 and $5,000 per year.

Detailed information and application forms may be obtained from Erling Johansen, chairman, department of dentistry and dental research of the school.

UNIVERSITY OF WASHINGTON MAKES FOUR APPOINTMENTS

The University of Washington has announced the appointment of Saul Schluger, Leo M. Sreebny, Dr. Bertram Kraus and Kenneth N. Morrison to the faculty of the School of Dentistry.

Dr. Schluger is professor of pedodontics and director of the graduate dental program. Dr. Sreebny is associate professor and executive officer of the department of oral pathology. Dr. Kraus is professor of physical anthropolgy in the department of orthodontics, and Dr. Morrison is associate professor and executive officer of the department of fixed partial dentures.

BAYLOR ANNOUNCES TWO GRADUATE PROGRAMS

Baylor University College of Dentistry, Dallas, Texas, has announced two advanced courses of study in periodontology and oral surgery beginning September 1958.

The first is a nine month course leading to a B.S.D. degree. This course consists of half advanced study in basic science and half clinical study.

The second, a twenty month course

leading to the degree of M.S.D., consists essentially of the work of the B.S.D. course followed by a summer term of clinical experience and a second full nine month term of advanced study in theory and clinical practice. A thesis is required.

For further information, write the registrar of the college.

MEMPHIS VA HOSPITAL OFFERS INTERNSHIPS, RESIDENCY

The Veterans Administration Medical Teaching Group Hospital of Memphis, Tenn., has announced that two rotating dental internships and one residency in prosthodontics will be available for the year beginning July 1958.

Information and application forms may be obtained from the chief of the hospital's dental service.

RESIDENCIES, INTERNSHIPS AVAILABLE THROUGH V.A.

The Veterans Administration has announced that an increased number of internships and residencies have been approved by the Council on Dental Education. The programs are conducted at 29 Veterans Administration hospitals throughout the country and begin July 1.

The internships are for one year. Residencies are offered in the fields of prosthodontics, oral surgery and periodontics and are for one or two years.

Students and graduates interested in the programs may apply to the manager of the V. A. hospital of their choice.

THREE COMPANIES CONTRIBUTE TO SETON HALL FUND

Three companies in the health field have made substantial gifts to Seton Hall College of Medicine and Dentistry in New Jersey.

Merck and Company, Johnson and Johnson and Warner-Lambert Pharmaceutical Company have contributed to the Founders' Fund of the college. The Merck gift of $100,000 will provide facilities and equipment for the pharmacology department. The funds from Johnson and Johnson will be used for the construction and equipping of a floor of the college, and the Warner-Lambert gift was given to found the physiology department.

DONOR TO EMORY UNIVERSITY, MRS. HILL, DIES AT 82

Mrs. DeLos Lemuel Hill, founder of a children's dental clinic at Emory University, died in Atlanta in February at the age of 82.

Mrs. Hill was the wife of an Atlanta-Southern Dental College professor. She was a past president of the Women's Auxiliary of the American Dental Association and was the first laywoman to become an honorary member of Omicron Kappa Upsilon. She gave $50,000 to found the dental clinic in 1931 and made later contributions toward its expansion.

UNIVERSITIES SCHEDULE POSTGRADUATE COURSES

Alabama • The University of Alabama School of Dentistry will present three refresher courses during May. Victor H. Sears will give a course in complete denture prosthesis May 1-3. Harry Sicher will conduct a two part program, consisting of "Surgical Anatomy of the Head and Neck" May 17-19 and "Etiology and Diagnosis of Pain of Dental Origin" May 20 and 21. Removable orthodontic appliances will be the subject of a course for orthodontists to be given by Samuel D. Gore May 24-26. Attendance in all courses is limited to 12. Tuition is $100 for all courses except part two of Dr. Sicher's course, for which tuition is $75. Both parts of the course may be taken for $150.

California • The University of California School of Dentistry will present a refresher course in fundamentals of nutrition and clini-

cal application in dentistry March 28 and 29. Lowell N. Peterson will be course chairman. The fee is $40.

Southern California • A course in practical root canal therapy will be presented March 15-18 by the University of Southern California School of Dentistry. John I. Ingle will be a guest instructor for the course. Tuition is $130.

Indiana • Indiana will present three courses during March and April. A postgraduate course in endodontics will be given March 10-12 and is designed as a continuation of the course on the subject given in 1957. Fee is $40. A postgraduate refresher course in operative dentistry will be given April 8-11. Fee is $40. The symposium on amalgam which is the part of the course to be given April 9 is free to those who cannot attend the four day program. A refresher course in crown and bridge construction is scheduled for April 14-18. Fee is $50.

Kansas City • University of Kansas City School of Dentistry has announced several refresher courses. Sholom Pearlman, assistant secretary of the Association's Council on Dental Therapeutics, will be on the faculty for a symposium on the current status of drugs in dentistry to be given March 5. Topics of other courses will be pedodontics, March 6; endodontics, March 5-7; oral surgery, March 5-7; and complete denture prosthesis, March 5-9. Alton K. Fisher will give a course in pathology and anthropology April 16-17.

Northwestern • Several refresher courses to be given at Northwestern University Dental School, Chicago, have been announced.

Orion H. Stuteville, Dr. Harold Westlake, Dr. Kenneth R. Bzoch, Morton S. Rosen, Dr. Frank W. Pirruccello and Sheldon W. Rosenstein will participate in the discussion and demonstrations on prosthetic rehabilitation for the cleft palate patient April 7 and 8. The course will be conducted with the cooperation of the Cleft Lip and Palate Institute of the school. The course on major oral surgery will be repeated April 7-11 for the benefit of the general practitioner who is particularly interested in oral surgery. Richard W. Tiecke will be the leader for a course on clinical features of oral lesions, which will be given April 16-18. Special attention will be given to lesions arising from the tooth follicle, and biopsy technic will be demonstrated.

Dr. J. Roy Doty, secretary of the Association's Council on Dental Therapeutics, will be guest lecturer during the course on the use of drugs in dental practice, April 30 through May 2, and Dr. Stanley C. Harris will be the leader. Diagnosis, roentgenography and treatment planning will be the subject of a course designed for general practitioners. Dan Y. Burrill will be the leader of the course, which is scheduled for May 5-7.

Tufts • Tufts University School of Dental Medicine, Boston, has announced four courses, one in hypnosis, being offered through the school's division of graduate and postgraduate studies. John E. Barr will be the instructor for a course in oral roentgenology April 22 and 23. Hypnosis and its clinical applications will be taught May 9-14 in day and night sessions. The subject will be approached especially from the dentist's viewpoint, although physicians and psychologists may also attend. Lawrence M. Staples of Boston, Milton H. Erickson, M.D., of Phoenix, Ariz., and Jacob Seidenberg of Chelsea, Mass., will be the instructors for the course. Full denture prosthesis will be taught June 2-6 by Irving Hardy, and Frederick Shiere, Helmi Fogels, Harold Berk and Philip McCaul will instruct in a three day course in dentistry for children beginning June 9.

Research

GORDON CONFERENCE ON BONES, TEETH TO BE HELD

The Gordon Research Conference on the Chemistry, Structure and Physiology of Bones and Teeth will be held at Kimball Union Academy in Meriden, N. H.

The conference is one of a series of conferences on various subjects to be held from June 9 to August 29. Further information can be obtained from W. George Parks, director, department of chemistry, University of Rhode Island, Kingston, R. I.

BECKER JOINS RESEARCH TEAM AT WORK UNDER PHS GRANT

Charles E. Becker, Ph.D., is new chief laboratory investigator for a research project being carried out in the Associa-

tion's division of chemistry in Chicago on how local anesthetic agents are metabolized by normal physiologic enzymes. The research is supported by an extramural grant (no. D-533) from the Public Health Service.

Dr. Becker, who received his Ph.D. degree in biochemistry from the University of Indiana, was research associate for four years with Dr. Clinton M. Geiman in the department of tropical public health, Harvard School of Public Health. More recently, he was chief of the research laboratory at the Veterans Administration Hospital, Louisville, Ky. Dr. Becker holds a reserve commission in the Medical Service Corps of the Army.

DENTAL DIVISION TRANSFERRED TO RESEARCH ARM BY COLGATE

The Colgate-Palmolive Company has announced the transfer of its division of dental medicine from the domestic toilet articles division to the newly formed corporate research and development department in recognition of the international and long range nature of dental research.

John W. Hein, dental director, will continue in charge of dental medicine research and will report directly to Dr. John R. Brown, Jr., who was recently appointed vice-president of research and development and a director of the company.

National Defense

NAVY DENTISTS TO CONDUCT STUDIES IN ANTARCTICA

Lieut. Charles E. Meyers, Dental Corps, U. S. Navy, will be a member of the International Physiological Expedition which will conduct studies on body response and adaptation to cold in Antarctica.

Lieut. Meyers will investigate whether changes occur in the oral flora when persons live in a low-temperature, practically germ-free environment for long periods. He will also assist the other five members of the international expedition in their studies.

AIR FORCE RESERVE GROUP ANNOUNCES 1958 OFFICERS

The Air Force Dental Reserve Officers' Association announced its new officers on the first anniversary of the group's founding in January. John S. Nelson of Pacific Grove, Calif., is president; Bruce J. Morrow, Macomb, Ill., president-elect; W. D. Schellig, New Baltimore, Mich., vice-president, and David Lewis, Wheaton, Md., secretary-treasurer. J. N. Stribling, Eatonton, Ga., Hugh D. Killmer, Houston, Texas, and Hubert Jackson, San Antonio, Texas, were elected to the executive board to serve for varying terms of office.

KENNEBECK RETIRES; CATHROE SUCCEEDS TO AIR FORCE POST

Brig. Gen. James S. Cathroe has been appointed assistant for dental services with the Air Force to succeed Maj. Gen. Marvin E. Kennebeck, who retired January 31.

General Kennebeck, who entered the Armed Forces in 1924 and became assistant for dental services in 1952, was awarded the Legion of Merit in recognition of his services by the Air Force surgeon general, Maj. Gen. Dan C. Ogle.

The citation read in part:

General Kennebeck . . . pioneered in the fluoridation of water supplied at Air Force bases; the initiation of the Air Force Preventive Dentistry Program . . .; the introduction of the Panoramic Dental X-Ray Machine; and the use of chrome cobalt alloy to replace gold in dental work. In addition, during General Kennebeck's assignment, dental officer and postgraduate training was expanded by over one hundred per cent. . . .

(L. to r.) Maj. Gen. Dan C. Ogle awards Legion of Merit to Maj. Gen. Marvin E. Kennebeck

General Cathroe entered the Armed Forces in 1928, and he was appointed deputy assistant for dental services in 1955. He is a graduate of Creighton University School of Dentistry.

James S. Cathroe

Fluoridation began at Fort Buckner, Okinawa, with opening of Tybase water treatment plant, one of several plants furnishing fluoridated water to Armed Forces personnel and their dependents. (L. to r.) Col. George M. Cookson, engineer; Mr. Alfred A. De Santo, sanitation supervisor; Col. Arthur N. Kracht, Army dental surgeon; Lt. Col. A. P. Herzer, Fort Buckner post engineer (with pointer); Mr. Takehito Nakahara, supervising chemist; and Lt. Col. Roswell G. Daniels, chief of preventive medicine.

NAVY TO USE SHORT-LIFE ISOTOPES IN DENTAL STUDIES

The establishment of a nuclear dentistry branch of the Naval Dental School, National Naval Medical Center, Bethesda, Md., was announced in January by the commanding officer, Capt. C. W. Schantz.

The branch will use short-life isotopes produced by a nuclear reactor recently installed in the Medical Center for clinical and laboratory research in dentistry. The isotopes will provide the same diagnostic information as longer half-life isotopes and will lessen the amount of internal body radiation to which subjects are exposed.

Captain Louis S. Hansen and Arne Nielsen will give instruction and training in the use of isotopes and their possible applications to dentistry. Capt. John B. Ferris has been appointed to the nuclear medicine committee and will act as coordinator between the dental and medical schools.

Subscripts • Col. Joseph L. Bernier, chief of the dental and oral pathology branch of the Armed Forces Institute of Pathology, was one of four dental surgeons who delivered lectures at the University of Santa Domingo in Ciudad Trujillo, Dominican Republic, recently. . . . 1st Lieut. Ralph G. Willie, a dental officer with the Army and now stationed in Europe, was 1957 first prize winner for the best essay on prosthetic dentistry. The American Denture Society sponsors the annual contest among senior dental students. . . . Col. Oscar J. Ogren has been named chief of the dental service at Brooke Army Hospital at Fort Sam Houston, Texas.

Public Health

PUBLIC HEALTH SERVICE ANNOUNCES EXAMS MAY 6-9

A competitive examination for appointment of dental officers in the regular corps of the United States Public Health Service will be held May 6-9 at a number of places throughout the country. The locations will be announced later.

Applications must be filed no later than April 11. Forms may be obtained from the Surgeon General, U. S. Public Health Service, Washington 25, D. C.

FLUORIDATION COMMITTEE PUBLISHES TWO HANDBOOKS

Two handbooks on fluoridation are available through the Committee to Protect Our Children's Teeth, a group headed by the noted pediatrician, Benjamin Spock.

Our Children's Teeth, priced at $1, is a 104 page book containing statements by leading authorities on the chemistry of fluoridation, a digest of experiences in major cities, a statement on the legality of the measure and a list of organizations supporting fluoridation. *Gains and Setbacks,* priced at $1.50, is a digest of experiences in over 30 communities and is designed as an aid in planning a public education drive.

The books can be ordered from the committee at 105 East 22nd St., New York 10.

KNUTSON HEADS BOARD OF DENTAL PUBLIC HEALTH

New officers of the American Board of Dental Public Health are John W. Knutson of Washington, D. C., president;

Philip E. Blackerby, Jr., of Battle Creek, Mich., vice-president and auditor; and Chester V. Tossy of Lansing, Mich., secretary-treasurer. Donald J. Galagan of Bethesda, Md., was elected to the examining board to succeed Walter J. Pelton.

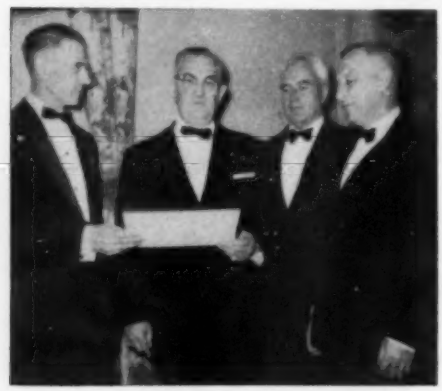
The board's next certifying examination will be given November 6 and 7 in Dallas, just prior to the annual meeting of the American Dental Association. Candidates should apply to the secretary not later than July 1.

General

HORACE WELLS CLUB HONORS DR. JOHN S. LUNDY WITH AWARD

The award of merit of the Horace Wells Club was presented to Dr. John S. Lundy of Minneapolis, who founded the section of anesthesiology of the Mayo Clinic in 1924 and is presently professor of anesthesiology in the Mayo Foundation, at the club's 63rd annual dinner in December.

The club is named for Horace Wells, a Hartford, Conn., dentist who discovered anesthesia. The group makes an annual award to a person who has contributed to the field of anesthesiology. E. Arthur Perry, a Bridgeport, Conn., dentist and president of the club, made the presentation.



(L. to r.) E. Arthur Perry, president of Horace Wells Club; John S. Lundy, M.D., recipient of award; Eugene M. Clifford, secretary-treasurer of club; and Ralph M. Tovell, M.D.

EMORY MORRIS AWARDED HONORARY DEGREE BY LOYOLA

Emory W. Morris, president and general manager of the W. K. Kellogg Foundation of Battle Creek, Mich., was the recipient of an honorary Doctor of Science degree at the midyear convocation of Loyola University in Chicago on February 5.

The degree was awarded "In view of his manifested qualities of imagination, analysis and judgment in the administration of his office and of his contributions to the health, knowledge and betterment of people throughout the world . . .," the citation said in part.

Dr. Morris is a graduate of the University of Michigan School of Dentistry. He became director of dental education of the Foundation in 1933 and head of the Foundation in 1943. Dr. Morris served two years as chairman of the Association's Council on Dental Health which was organized in 1943.

ACADEMY OF ORAL PATHOLOGY TO MEET IN WASHINGTON

The American Academy of Oral Pathology will meet in Washington, D. C., March 29-31, at which time the fellowship examination will be given. The group's scientific session is scheduled for March 30, with a symposium on odontogenic tumors planned for March 31 at the Armed Forces Institute of Pathology.

Charles A. Waldron is president of the

academy. Other officers are Henry H. Scofield, first vice-president; Robert J. Gorlin, second vice-president; David Mitchell, editor, and Joseph L. Bernier, secretary-treasurer. William G. Shafer is a member of the executive committee and Robert A. Colby, a member of the academy's board of directors.

MEDICAL LIBRARY GROUP TO HOLD MEETING IN JUNE

The theme of the 57th annual meeting of the Medical Library Association to be held June 2-6 in Rochester, Minn., will be "Advances in Medical Library Practice."

Refresher courses in 12 areas of medical library work will be given on May 3 preceding the meeting. Participants will be able to attend four of the hour and a half sessions.

Medical specialists from the Mayo Clinic will speak on what specialists need from medical libraries on one day of the association meeting.

The American Dental Association takes an active part in the activities of the association, in which librarians in medicine, dentistry and allied fields participate, according to Donald Washburn, Director of the Bureau of Library and Indexing service.

The Association was host to a Midwest regional meeting of the group in the Central Office in late January.

LEDERLE PUBLISHES NEWSPAPER ON DENTISTRY

Lederle Laboratories, a drug division of American Cyanamid Co., published the first issue of a new tabloid-size monthly newspaper devoted entirely to dentistry March 1.

The newspaper, *Dental Times,* will be published monthly by the company and will be free to all dentists. The first issue features an article on radiation and also contains a picture story on dental hypnosis, news of dental meetings and an article on the Jenkins-Keogh plan.

PERIODONTISTS FORM NEW MIDWEST SOCIETY

A group of periodontists, meeting at Northwestern University Dental School in February, formed a new organization to be known as the Midwest Society of Periodontology. Irving Charles Stone of Chicago was elected first president of the Society.

Other officers include J. C. Penticuff, Kansas City, Mo., president-elect; Genevieve C. Roth, Kansas City, secretary; and A. G. R. Hoaglund, Minneapolis, treasurer.

Other members of the executive board include Kenneth W. Carlson, Vernon J. Haas, Luke Howlett, Gerald T. Ivancic, Bennett Klavan, Erwin M. Schaffer and Henry M. Swenson.

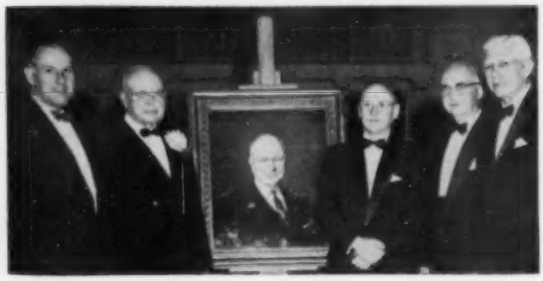
Donovan W. Brown is chairman of the advisory board, of which Edgar D. Coolidge, Maynard K. Hine, Joseph Jacobs, Raymond Johnson, Donald A. Kerr, Robert G. Kesel and G. R. Lundquist are members.

Clarke E. Chamberlain, Peoria, Ill., is honorary president of the Society.

NORTHWESTERN DENTAL SCHOOL PLANS APRIL 23 HOMECOMING

A lecture by Harold J. Noyes, dean of the University of Oregon Dental School will highlight the homecoming program at Northwestern University Dental School April 23 in Chicago.

The alumni association of the school has also planned table clinics and a complimentary luncheon, at which the 50-year class will be presented, for the day long program. No registration fee will be charged.



(L. to r.) John E. Buhler, Malvern D. Huff, Nathan T. Teague, William A. Garrett and H. Harvey Payne.

COLLEAGUES HONOR M. HUFF WITH PORTRAIT

His distinguished contributions to dental education, research and to the profession inspired the colleagues and friends of Malvern D. Huff to honor him at a dinner. High light of the occasion was the unveiling of his portrait, which then was presented to John Buhler, dean of the School of Dentistry, Emory University, Atlanta, with instructions that it be placed in the school's Sheppard W. Foster Library.

Doctor Huff was graduated from Southern Dental College in 1901. He is a former chairman of the Association's Council on Research. During his service as a trustee of the Atlanta Southern College, he actively campaigned for that College's merger with Emory University. In 1944, this ambition was realized.

Still in active practice, Dr. Huff also participates regularly in the Rotary Club, of which he is a charter member.

DESCRIPTIONS REQUESTED OF HISTORIC DENTAL ITEMS

The American Academy of the History of Dentistry has been requested by the Smithsonian Institution of Washington, D. C., to assist in developing a hall of dentistry for the Institute's new building which is scheduled for completion in 1960.

Persons with items of possible historical interest, such as equipment, instruments, appliances and dentures, are asked to send a description of the items to C. Willard Camalier, president of the academy and chairman of the advisory committee to the Smithsonian Institution, at 1726 Eye Street, N. W., Washington, D. C.

No items should be sent to the academy or Smithsonian at this time.

MEMORIAL SERVICE MARCH 15 TO HONOR ARNO B. LUCKHARDT

A memorial service will be held for Dr. Arno B. Luckhardt March 15 in Billings Memorial Hospital of the University of Chicago.

Dr. Luckhardt, who discovered the anesthetic properties of ethylene gas and was awarded an honorary membership in the Association at the 93rd annual session in November, died November 6 at the age of 73. He had served as professor of physiology at the University of Chicago and was one of the original members of the Association's Council on Dental Therapeutics.

Speakers for the service will include Dr. Lawrence A. Kimpton, chancellor of the University of Chicago; Dr. John O. Hutchens, professor and chairman of the department of physiology; and Dr. William W. Scott, professor of urology, Brady Urological Institute. Dr. Lowell T. Coggeshall, dean of the divisional sciences, will preside.

Resolutions passed by German fluoride experts

There are increasing signs that opponents of fluoridation of drinking water in America are using the same arguments, which became obsolete long ago, in an attempt to discredit in Germany and Europe hygienic measures which are in a position to reduce considerably the attack rate of dental caries, either by fluoridation of drinking water, the administration of tablets or the fluoridation of milk and salt. Words such as "poison" and "subsequent injuries" are consciously used with a view toward intimidating the unprejudiced. German scientists, who for more than 20 years have studied the toxic and physiological effects of fluorine ions, have arrived at the following expert opinion *(Zahnärztliche Praxis,* August 14, 1957):

1. On the basis of exhaustive and unbiased studies in sections with water naturally containing fluoride or with controlled fluoridation of drinking water, there can be no doubt that the addition of fluorine is capable of considerably diminishing the caries rate. Although other factors without doubt are also significant in the problem of caries, in accordance with present knowledge, they are inferior to fluorine in significance and effectiveness for preventive measures.

2. Other measures aimed at restriction of the spread of caries (stressing of oral hygiene and prevention of rachitic vitamin deficiency) have been without result in spite of decades of application. Insignificant fluctuations and regressions have been observed in small areas, but the frequency of caries seen at large has always been on the increase.

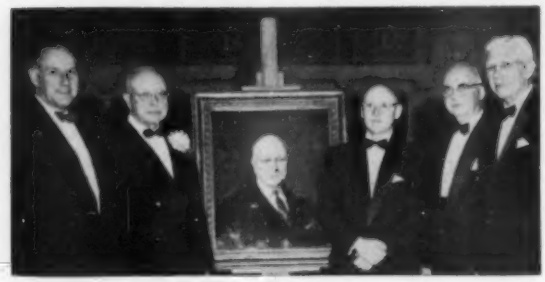
3. The addition of fluorine to drinking water is the most reliable method of administration. In some regions of the globe nature has supplied drinking water with exactly the amount of fluorine optimal for the preservation of teeth. Consequently, controlled fluoridation should by no means be considered as adulteration of drinking water; it should rather be regarded as a measure imitating nature, the purpose of which is to make water that is poor in minerals into drinking water containing optimal amounts.

4. Observation of millions of humans who for generations have consumed drinking water with optimal fluorine content and, therefore, have exhibited hardly any caries, has demonstrated the innocuousness of adding fluorine to drinking water. Consequently, the alleged danger of subsequent injuries caused by fluoridation may be excluded with a probability bordering on certainty.

5. Without doubt, lack of fluorine in the drinking water is not the immediate cause of dental caries. Rather, in this regard, carbohydrates or bacteria enter the picture, but we cannot conceive of any life without carbohydrates and bacteria. One of the methods indicated by nature for restricting the spread of caries undoubtedly promises the greatest success at the moment. This method is the consumption of drinking water rich in fluorine. We should not hesitate to follow this path indicated by nature. All hindrances blocking the path must be eliminated in the interest of health and humanity.

(signed) Prof. H. D. Cremer, Giessen
Prof. Dr. Dr. Münch, Berlin
Prof. Dr. Eichler, Heidelberg
Prof. Dr. Knappwost, Tübingen
Dr. Hornung, Kassel
Dr. Hoffmann-Axtheim, Berlin
Dr. Dr. H. J. Schmidt, Stuttgart

The viewpoint in the opinion quoted is identical with that in the resolution passed by the British Ministry of Health, the Swiss resolution of March 3, 1957, the Austrian procedure, the position adopted by Sweden, the Polish propositions and the position of the Fédération Dentaire Internationale, in all of which the decisions of experts were involved.



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2. Other measures aimed at restriction of the spread of caries (stressing of oral hygiene and prevention of rachitic vitamin deficiency) have been without result in spite of decades of application. Insignificant fluctuations and regressions have been observed in small areas, but the frequency of caries seen at large has always been on the increase.

3. The addition of fluorine to drinking water is the most reliable method of administration. In some regions of the globe nature has supplied drinking water with exactly the amount of fluorine optimal for the preservation of teeth. Consequently, controlled fluoridation should by no means be considered as adulteration of drinking water; it should rather be regarded as a measure imitating nature, the purpose of which is to make water that is poor in minerals into drinking water containing optimal amounts.

4. Observation of millions of humans who for generations have consumed drinking water with optimal fluorine content and, therefore, have exhibited hardly any caries, has demonstrated the innocuousness of adding fluorine to drinking water. Consequently, the alleged danger of subsequent injuries caused by fluoridation may be excluded with a probability bordering on certainty.

5. Without doubt, lack of fluorine in the drinking water is not the immediate cause of dental caries. Rather, in this regard, carbohydrates or bacteria enter the picture, but we cannot conceive of any life without carbohydrates and bacteria. One of the methods indicated by nature for restricting the spread of caries undoubtedly promises the greatest success at the moment. This method is the consumption of drinking water rich in fluorine. We should not hesitate to follow this path indicated by nature. All hindrances blocking the path must be eliminated in the interest of health and humanity.

(signed) Prof. H. D. Cremer, Giessen
Prof. Dr. Dr. Münch, Berlin
Prof. Dr. Eichler, Heidelberg
Prof. Dr. Knappwost, Tübingen
Dr. Hornung, Kassel
Dr. Hoffmann-Axtheim, Berlin
Dr. Dr. H. J. Schmidt, Stuttgart

The viewpoint in the opinion quoted is identical with that in the resolution passed by the British Ministry of Health, the Swiss resolution of March 3, 1957, the Austrian procedure, the position adopted by Sweden, the Polish propositions and the position of the Fédération Dentaire Internationale, in all of which the decisions of experts were involved.

The Reader Comments

THE JOURNAL *devotes this section to comment by readers on topics of current interest to dentistry. The editor reserves the right to edit all communications to fit available space and requires that all letters be signed. At the request of the author, signatures will be deleted before publication. Printed communications do not necessarily reflect the opinion or official policy of the Association. Your participation in this section is invited.*

The Editor

ADMINISTRATION OF LIDOCAINE AND EPINEPHRINE

The article, "Epinephrine with local anesthesia in hypertensive patients," in the December 1957 issue of THE JOURNAL brings to mind an observation I have made on three of my patients.

Three persons who regularly developed palpitations after the injection of lidocaine (Xylocaine) hydrochloride with epinephrine (1:50,000) did not do so when an injection of lidocaine without epinephrine was given five minutes earlier.

The following could be possible causes: (1) absorption of sufficient lidocaine to counteract the untoward effects of epinephrine in the second injection and (2) emotional factors such as fear of injection and painful injection might intensify the reaction to epinephrine. A painless second injection could result in better tolerance of the epinephrine.

This procedure might be worthwhile for patients with cardiovascular disorders.

Arnold Ehrlich, D.D.S., New York

MULTIPLE EXTRACTIONS UNDER SELF-HYPNOSIS

Since 1939 I have been treating a patient who is known to me to be a business man of standing and a leader in community activities. He is 45 years of age.

For some years he has done intensive research in the fields of progressive relaxation, hypnosis, and autosuggestion and is a member of organizations whose aim is to further the cause of therapeutic hypnosis. He has confined his activities in this field to his family and intimate friends.

At my office, he has previously hypnotized successfully members of his family so that dental work has been performed which could not have been done as speedily or successfully under normal circumstances.

On October 26, 1957, I informed the patient that it would be necessary for me to extract three of his upper incisors. At that time he told me of his intention to have the extractions done under self-hypnosis. He also said he would strive for very little bleeding. At this time I took a hydrocolloid impression of his mouth for the purpose of adding new teeth to an existing partial denture.

On November 9, 1957, the patient returned to my office approximately 30 minutes prior to his appointment. He proceeded with a self-hypnotic induction technic while seated in my outer office. Later, when seated in my dental chair, he appeared completely relaxed.

I then proceeded as follows: I tested the gingiva for anesthesia. It was positive. The patient appeared completely relaxed. His breathing was normal. I then proceeded to extract the upper right and left central incisors. There was no evidence of pain or discomfort. I quickly called my hygienist from my other operatory to witness the third extraction. In open-mouthed amazement she watched me extract the upper left lateral incisor, thoroughly compress the alveolar plate and insert the upper partial denture. There was minimal bleeding.

After the extractions, I awakened the patient from his self-hypnotic sleep and he reported that he had felt no pain. He stated that at all times he had been fully aware of the work being performed and that although there had been a sense of pressure it had not been greater than that he had previously felt with extractions under local anesthesia. He further stated that he had no headache or other disturbances.

About ten minutes later, competently and in a relaxed manner, he proceeded with the hypnosis of his 15 year old daughter, during which I excavated and filled three Class I cavities.

On each of the next two days, the patient phoned me to report that he had no discomfort at all. On November 23, he returned to my office at which time an examination of his mouth disclosed that healing was proceeding normally.

Harry L. Sussman, D.D.S., Brooklyn

Test your tax I.Q.

Test your knowledge of the federal income tax law on this quiz prepared by the American Institute of Certified Public Accountants in cooperation with the Internal Revenue Service. You will find the correct answers at the end of the article.

1. During the past year you spent approximately $1,000 for built-in bookcases and wall-to-wall carpeting for your office. Since your lease has only four years to run, you may . . .
   (a) Deduct the $1,000 on your 1957 tax return
   (b) Amortize the cost over the next four years
   (c) Depreciate it over the life of the furnishings

2. You have invested in several blue-chip stocks. The dividends received from this investment are exempt up to . . .
   (a) $50 whether you or your wife owns the stock
   (b) $100 if the stock is held jointly by you and your wife
   (c) $100 regardless of who owns the stock, providing you file a joint return with your wife

3. You are not permitted to deduct as contributions your donations to which of the following organizations . . .
   (a) Charitable societies
   (b) Educational institutions
   (c) Political parties

4. Your daughter, who was hospitalized for several weeks in the earlier part of 1957, was married in November. If she files a joint return with her husband, you may . . .
   (a) Not claim her as a dependent but you may deduct her medical expenses
   (b) Claim her as a dependent and deduct her medical expenses
   (c) Not claim her as a dependent and you may not deduct her medical expenses

5. You filled very few inside straights during the past few months and lost approximately $300 to the members of your Thursday night poker club. You should . . .
   (a) Deduct the loss in computing adjusted gross income
   (b) Subtract the loss from adjusted gross income
   (c) Give up poker and start watching television on Thursday nights

6. Last October your car skidded on a wet road and grazed a telephone pole. The damage was not covered by insurance and it cost you $100 to have the car repaired. To claim a casualty deduction . . .
   (a) You must have the damage repaired within 30 days of the accident
   (b) You may simply deduct the amount of the repair bill
   (c) You must prove that you were using the car in your work at the time of the accident

7. Which of the following may you not consider as a deductible business expense . . .
   (a) A subscription to your professional publications

(b) Commutation fees
(c) The costs of attending the annual American Dental Association and your annual state dental association meeting

8. While playing hide-and-seek in your backyard, the neighbor's children trampled and killed several of your more expensive bushes. The cost of replacing this shrubbery . . .

(a) May be deducted if it does not exceed the original cost of the bushes
(b) May be deducted only if the parents of the children refuse to pay damages
(c) May not be deducted under any circumstances

9. Your daughter works as a full-time receptionist for you during the summer months and you pay her a weekly salary. Since she is a full-time employee, she is . . .

(a) Required to pay social security
(b) Not subject to social security
(c) Permitted to decide whether she does or does not want social security coverage

10. Last year you gave your church a small piece of property for which you had paid $500 some time ago. Its value at the time of the gift was $1,500. As a result . . .

(a) You may claim a tax deduction of $1,500
(b) You must pay a capital gains tax on the $1,000 increase
(c) You may claim a tax deduction of $500

11. There were a few leaks in the shingle roof of your office building; so you constructed a new tile roof. You should . . .

(a) Consider this as a repair bill and deduct the entire amount as a business expense on your 1957 return
(b) Regard this as a capital improvement and depreciate the cost over a period of years
(c) Add the cost of the repair to the value of the property

12. After you have filed your personal 1957 tax return, the Government is allowed to check your return and bill you for additional tax. The period of time in which this may be done ends . . .

(a) On the day you file your 1958 return
(b) Two years after you file your 1957 return
(c) Three years from the due date of your 1957 return

13. On the advice of a friend, you engage a CPA to prepare your 1957 tax return. The fee he charges for this service is . . .

(a) Not deductible since it is a personal expense
(b) Not deductible if you are entitled to a refund
(c) Deductible in full

CORRECT ANSWERS

1. (b) On leased property, you normally spread the cost of improvements over the shorter period—the life of the improvement or the term of the lease. Since your lease expires in four years and presumably the furnishings will have a longer life than that, you should be able to claim a $250 deduction on your federal tax return for this year and the next three years.

2. (a) and (b) are both correct. All taxpayers are entitled to a $50 dividend exemption. A husband and wife can combine their exemptions and receive $100 in dividends tax free, providing the stock is jointly owned. The filing of a joint return will not qualify them for this double exemption if the stock is held in only one of their names.

3. (c) You cannot deduct contributions to an organization which spends a substantial part of its time lobbying or

distributing political propaganda.

4. (a) You gained a son-in-law but lost a $600 dependency exemption for 1957 when your daughter married in November. All is not lost, however. If you provided more than one half of your daughter's support during the year, you may claim her medical expenses as a deduction on your return.

5. (c) Watching television can be most relaxing and it might even help you to forget your poker losses—which is the thing to do because net gambling losses are definitely not deductible. Net gambling gains are taxable as income; so if you won money in a football pool or other sources, you may use your poker losses to offset these gains.

6. (b) The IRS has ruled that "if the repairs do nothing more than restore the property to its condition immediately before the casualty and do not add to (its) value, utility or useful life, such repair costs may be used as a measure of the value of the destroyed portion." Where you were going at the time of the accident does not affect the deductibility of car damages.

7. (b) Commutation fees are not a deductible business expense. The cost of going to and returning from work, whether it be by bus, cab, train or plane, is not deductible since it is a personal expense. On the other hand, a and c are deductible.

8. (c) Damage to your shrubbery caused by children, dogs or errant lawnmowers is not deductible. If your home or lawn is damaged by fire, storm or flood, the loss not covered by insurance may be deducted. When large amounts are involved it is wise to have an expert appraisal made immediately after the casualty.

9. (b) Since your daughter works for you, you are not supposed to pay social security tax on her wages, nor is she required to make contributions.

10. (a) Your deduction for a charitable contribution is the value of the gift at the time it is made. You are not considered to have realized a taxable gain or deductible loss when you give property away. You may claim a deduction for the entire $1,500 so long as this amount does not exceed 20 per cent (30 per cent in some cases) of your adjusted gross income.

11. (b) The roof is considered an improvement, not an ordinary repair. The cost of replacing the roof is deductible as depreciation spread over its estimated useful life.

12. (c) In the absence of fraud or substantial understatement of income, the Government has three years from the due date of your 1957 return to check your return and bill you for additional tax. Since the due date of most individual returns is April 15 and for investigation purposes all returns are treated as though filed on the due date, you should be sure to save all check stubs and receipted bills to prove your declared deductions until April 15, 1961.

13. (c) The fee which a CPA charges you to prepare a tax return or defend the accuracy of your return before the Treasury Department is deductible in full if you itemize deductions.

COUNCIL ON DENTAL HEALTH

Budget payment plans for the individual purchase of dental care: V

The previous installments of this manual, "Budget Payment Plans for the Individual Purchase of Dental Care," published in the September, October, November and December 1957 issues of THE JOURNAL[1] summarized the observations on this subject of the Council on Dental Health since its establishment in 1942. With the inception of the Detroit Dental Society Payment Plan in 1941 and the spread of such plans to other states, the Council was provided with experience data on which to base an evaluation of these plans and to develop guidance materials for state dental societies in the establishment of new plans or in the improvement of existing ones.

The symposium presented in the February 1958 issue of THE JOURNAL[2-6] provided further information on the operating experience of several plans. These papers constituted a major portion of the program of the 8th National Dental Health Conference sponsored by the Council last April and provided the discussion topic for one of the three workshop groups. Out of the group discussions came recommendations that assisted the Council in the preparation of a statement, "Principles for Budget Payment Plans for Dental Care." The statement, which was approved by the Association's House of Delegates in November 1957, constitutes a vital addition to the manual and is presented at the conclusion of this installment.

At the conference, it was pointed out that methods for meeting the cost of dental care could be classified as:[7] (1) direct purchase of dental care by an individual through his own personal resources; (2) purchase of dental care by an individual through an organized program (budget payment); (3) purchase of dental care by a group through an organized program (group purchase), and (4) payment for the cost of dental care through application of the insurance principle. The fourth method has been receiving increasing attention from the Council and will be the subject of a Council report in a future issue of THE JOURNAL.

Although this report is devoted to the subject of budget payment, the observations of the Council in regard to the earlier terminology of "prepayment" and

1. American Dental Association, Council on Dental Health. Budget payment plans for the individual purchase of dental care: I. J.A.D.A. 55:446 Sept.; II. 55:578 Oct.; III. 55:730 Nov.; IV. 55:880 Dec. 1957.

2. American Dental Association, Council on Dental Health. Development and operation of budget payment programs for the individual purchase of dental care. J.A.D.A. 56:167 Feb. 1958.

3. Wilson, John B. Description of a successful budget payment plan. J.A.D.A. 56:168 Feb. 1958.

4. Davis, Phyllis Hart. Function of the dental society staff in the over-all operation of a budget payment plan. J.A.D.A. 56:183 Feb. 1958.

5. Rutledge, C. Edward, and Rooks, John G. Impact of budget payment on the business practices in the dental office. J.A.D.A. 56:174 Feb. 1958.

6. Gesell, Emery J. Problems and responsibilities of the bank in the operation of a dental budget payment plan. J.A.D.A. 56:171 Feb. 1958.

7. American Dental Association, Council on Dental Health. The state council on dental health program and the support available from the Association. Kirby, Joseph V. J.A.D.A. 55:112 July 1957

"postpayment" should be pointed out. The Council found the term "prepayment" to be vague and meaningless and, in its place, adopted the more descriptive term "group purchase programs for dental care." The Council found, likewise, that the term "postpayment" was indefinite and did not describe the actual mechanism used. Under such a plan, the patient knows in advance exactly how much his dental care will cost, and he can budget his payments as he does those for other items—a house, an automobile, a television set. In this regard, however, banks have stressed the fact that the individual's payments must fit into his budget, or the plan is not truly a budget payment plan.

The major problem in the application of the insurance principle to payment for dental care is the burden of the cost of treatment of pre-existing conditions. The cost of initial care might be met through use of the budget payment type of program, leaving the maintenance cost to be met through an insurance program. Hence, the Council sees the possibility of increased utilization of the budget payment mechanism in conjunction with the expansion of commercial health insurance plans to include dental benefits.

PRINCIPLES FOR BUDGET PAYMENT PLANS

The following statement, "Principles for Budget Payment Plans for Dental Care," was adopted by the House of Delegates of the American Dental Association in November 1957 at Miami Beach, Fla.:

1. The most desirable method of making a budget payment plan available to all of the people in a state is through a plan operated on a state-wide basis. It is desirable, therefore, that budget payment plans be developed by the state society or that plans which are developed at the component level be expanded or associated in order to provide state-wide coverage as rapidly as possible.

2. The plan should be administered by the sponsoring dental society in accordance with regulations established by the society through the agency to which it has assigned responsibility for operating the plan.

3. The disposition of complaints arising from the financial operation of the plan should be the responsibility of the plan's governing body.

4. The disposition of complaints arising from the dentist-patient relationship should be the responsibility of the dental society's mediation or counseling committee which normally handles all such complaints. The availability of mediation or counseling service is essential to the successful operation of a budget payment plan.

5. The plan should include a continuing program of education for the membership in order to effect maximum utilization and to avoid the unnecessary burden of improper use.

6. The policies governing the management of the loss reserve of the plan should have the approval of a majority of the participating dentists and should be developed and adopted only with the advice and assistance of competent legal and tax counsel.

7. The plan should make provision for semiannual audits and such additional statistical evaluations as may be necessary to determine appropriate adjustments or alterations of the plan in the interest of the public, the dentists and the bank.

8. The promotion of the plan to the public should be in keeping with the *Principles of Ethics* of the American Dental Association and the codes of ethics of the sponsoring constituent and component dental societies. The promotional information should follow the highest standards of dental health educational concepts.

9. All members of the sponsoring society should be eligible to participate in the plan within the agreed limitations of the plan.

10. The maximum success of the plan depends upon maximum participation by the membership of the sponsoring society.

BUREAU OF ECONOMIC RESEARCH AND STATISTICS

A motivational study of dental care. I

This study was conducted for the American Dental Association by Social Research, Inc., an agency specializing in motivational research. This is a "pilot" study, intended to provide experience and background for larger scale investigations in the future. Based on a small number of long and intensive interviews, it is not intended to be a statistical study. The 126 people interviewed were encouraged to talk freely about all aspects of dental care, and indirect methods of questioning were used to reveal underlying motives which the respondent would not or could not consciously divulge. The interview results were interpreted and this report was prepared by behavioral scientists on the staff of Social Research, Inc. This is the first of four monthly installments of the report.

INTRODUCTION

This report presents and discusses the main findings of a social psychological study of attitudes toward dental care. Its purpose was to seek out the more important attitudes toward dental care, as held by a representative group of people, and within the scope of an exploratory research project to illuminate various factors which motivate people to care for or to neglect their teeth.

That people have many attitudes toward their teeth and toward caring for their teeth, and that these attitudes and their associated behaviors are complexly motivated, is perhaps the most obvious and yet the most striking observation of this research. Both the variety and complexity of attitudes will become apparent in the text of this report. By way of orientation, it can be pointed out in this introductory statement that feelings about teeth—and therefore about dental care—begin to develop very early in life, that they are intimately connected with a person's first pleasures and frustrations, and that they are supported and concealed by many personal and private, essentially unconscious meanings.

Throughout life teeth have many uses: we use them for eating and biting; we display them to other people in all types of oral activities; we express emotions and moods with our teeth; we experience pain and pleasure through our teeth. Used every day of a person's life, closely connected in fact and fantasy with problems of health, growth, and aging, there is yet a pronounced tendency to take teeth for granted (at least among some segments of the population), to adhere to irrational beliefs and unsound practices in the dental area, to learn many rules and rationales for proper dental care but not always to make use of them.

Teeth are a bodily part considered important in all types of social situations and relations. People readily see teeth as symbolizing a person's character and values, his style of life and his socioeconomic class, and attitudes toward dental care involve these interpersonal factors. They also refer to the fact that dental care is something that is taught in both direct and indirect ways: parents, peers, teachers, and dentists serve as instructors and models in this area of body care, and how people feel about and relate to these different figures are of consequence in determining the type of care they give or do not give to their teeth. For from these sources people come to have many beliefs,

opinions, superstitions, rationales, and fantasies about teeth and dental care, and in these social situations they learn many of the problems, rewards, and disadvantages associated with caring for or neglecting their teeth.

These, then, are but a few of the complicating factors encountered in a social psychological study of dental care, and from which two implications are immediately apparent. One is that an attempt to understand attitudes toward dental care cannot be confined to a rational, logical level, seeking what people do or do not do for their teeth and accepting at face value their reasons for these practices. Of greater significance are the underlying, and always emotionally toned, factors—the meanings teeth and dental care have for people which in large measure determine what, how, and why they care for them. In this research report emphasis is given to these considerations.

A second implication refers to the scope and presentation of this research. As originally designed, this was to be a pilot study of attitudes toward dental care, and this report should not be considered as anything more than a pilot, exploratory investigation. For more complete, definitive, and conclusive answers to the many problems encountered, a more intensive study would have to be done. Our purpose here is merely to focus on some of the more important issues and problems, to present a few partial answers as best as possible in terms of our limited data, and to give indications where further research would be most profitable.

For this pilot research, 126 men, women, and children living in a typical midwestern community were interviewed. The community was selected by the American Dental Association; respondents were selected by Social Research, Inc. interviewers in accordance with a quota sampling plan to cover age, sex, and socioeconomic variables. The distribution of the initial sample of 116 respondents is as follows:

Age distribution:	N	%
14-19 years	30	26
20-49 years	49	42
50 and over	36	31
D.K.	1	1
Total	116	100
Sex distribution:		
Men	59	51
Women	57	49
Total	116	100
Social class distribution:[1]		
Upper middle class (UM)	17	15
Lower middle class (LM)	37	32
Upper lower class (UL)	44	38
Lower lower class (LL)	18	15
Total	116	100

A cross-tabulation of these three variables appears in Table 1.

In addition to the interviews already referred to, ten other interviews were collected with teen-agers who wear braces and adults who have dentures. The purpose in collecting these interviews was to get further—though by no means complete—information regarding aspects of dental care which came to the fore in connection with braces and false teeth.

Table 1 • Sample description (N=116)

	Age	Men	Women	Total	
Upper	14-19	3	2	5	
Middle	20-49	3	2	5	
Class	50+	3	3	6	
(17)	D.K.	1	—	1	
					17
Lower	14-19	3	5	8	
Middle	20-49	9	10	19	
Class	50+	8	2	10	
(37)					37
Upper	14-19	6	6	12	
Lower	20-49	9	6	15	
Class	50+	5	12	17	
(44)					44
Lower	14-19	3	2	5	
Lower	20-49	4	6	10	
Class	50+	2	1	3	
(18)					18
Grand total					116

1. A discussion of the social class variables, especially in connection with attitudes toward dental care, is presented in chapter II.

This report is divided as follows: the first chapter presents some of the common meanings and attitudes associated with teeth and dental care. Chapter II discusses social class in connection with dental care, focusing on how this variable is an important consideration in accounting for why people care for or neglect their teeth. Chapter III has to do with the development of attitudes toward teeth—the psychological meanings of teeth and how they affect later dental behavior. In chapter IV we elaborate on problems and pleasures associated with dental care, reviewing in more detail some of the considerations contained in chapter I. Chapter V pertains to feelings people have about dentists—who they are, what they do, when and why they should be used. And in chapter VI we summarize the main findings of this research and suggest areas for further investigation.

SOME MEANINGS OF TEETH AND DENTAL CARE

We begin this report by presenting several of the typical ways in which people conceive of and feel about teeth and dental care. As represented by this sample, these notions and attitudes are shared by all people, with little variation among different age levels or social class groups, among people who have "good" or "bad," natural or artificial teeth, who regularly or infrequently see a dentist. Together, these can be thought of as comprising the core notions people have about teeth and dental care. Seemingly, these meanings and their accompanying attitudes are learned early and tend to persist throughout adulthood. They are commonly taken for granted, are the subject of little thought or reflection, assumed to be "truths and values," supported in various ways by a body of traditions, folklore, superstition, scientific knowledge, and common-sense.

The most general of these attitudes is that teeth and dental care are important. That teeth are important is an assumption consistently made by all people, and that taking care of teeth is important is a value subscribed to in word or in deed by almost everyone. We find that regardless of what type of care a person gives to his teeth—and there is much variation in dental care practice among our sample—there always is the awareness of the importance of this part of the body and the "knowledge" that dental care is of consequence in maintaining good, healthy teeth. People do not question this fact; instead, it is something felt to be true.

This pilot inquiry finds this attitude to be related to several other considerations, some pertaining directly to teeth, others to feelings people have about themselves and about the world in which they live and in terms of which teeth take on meaning and significance. These can be enumerated as follows:

Teeth Are Essential • Teeth are thought of as having a purpose, one which indicates that teeth are essential to the individual and to his life. This is a feeling people have about most body organs and parts; it is especially pertinent to those body parts having some "internal" significance. Teeth, which are both internal and external, carry with them the feeling that they are vital to life, and as such are deemed important to have and to maintain.

The function of teeth is defined as biting and chewing; they are part of the process of eating—of taking in and digesting food. This is their utilitarian definition, and when we ask respondents to complete the sentence stem, "teeth are used . . .," we evoke two types of an-

swers: one pertaining to the role of teeth in eating, as in the following:

. . . to grind food with.
. . . for eating.
. . . to masticate food.
. . . to chew up our food.
. . . to help digest food, I suppose.
. . . to bite with.

and the other to their constancy of use, as in these sentence completions:

. . . a lot—they're a most essential part.
. . . constantly.
. . . every day.

Both types of responses allude to the notion that teeth are practical, have definite uses, are utilized repeatedly, and are essential to a person's well being and life. And all of these functions contribute to the feelings that teeth are important to the individual, objects to be valued, and carry with them the implication that they should be cared for.

Teeth Have Many Social and Personal Meanings • People feel that teeth are of importance in a more "external" way, namely, in terms of social and interpersonal situations and relations. There is a tacit recognition throughout the interview responses that teeth are of significance for a person's appearance: how one presents himself to other people, and how this will influence other people's feelings about him.

Though closely related to considerations of function and use, this more external meaning of teeth is of consequence in and of itself. References such as beautiful, straight, dirty, crooked, pearly white, yellow, and false teeth (to mention but a few such descriptive statements) are commonly made and emphasize the social value of certain types of teeth and the role of teeth in many types of social situations. In an attempt to get at some of these common social definitions, respondents were given several brief descriptions of teeth and were asked what they thought "each of these people might be like." Their comments—and over-all they indicate a large degree of consensus as to what social meanings different types of teeth have in our culture—suggest how teeth are important in the way we size-up other individuals, make judgments and form opinions of them. For the statement, "She has lovely, even, white teeth," these are some of the descriptions:

"She would be fair and good looking, a neat, clean person."

"A pretty person always smiling."

"A good looker."

"That's some person that takes care of their self, personally. I mean, they try to look good and neat."

"Very clean; a good housekeeper."

"A young girl that has taken care of her teeth. A very clean, neat, and nice person."

A person with a "toothy grin" brings to mind the following images among our respondents:

"A small, cocky fellow."

"I think of an ignorant person or an idiot."

"Somebody who should have had their teeth tended to, but maybe didn't have money."

"Some old hag, like the woman who lives down the street. She's sort of unbalanced."

And for the description, "bad breath," the response is:

"Someone that eats onions and don't wash their teeth good."

"That's caused by bad health—an unhealthy person."

"A careless person."

"An obnoxious sort of person."

"Either bad eating habits or an upset stomach causes this, so it must be a person that's always on the go."

"Someone who has bad habits."

These examples indicate how, on the basis of short descriptive statements regarding teeth and dental care habits,

Table 2 • Age, sex and occupation selected on the basis of descriptions of teeth (in %; N:116)

	A man	A woman	5 yr. old person	18 yr. old person	40 yr. old person	70 yr. old person	Successful business person	Sales-person	Factory worker
Yellow teeth	47	9	22	13	46	75	4	9	66
White teeth	3	43	47	43	6	3	71	72	9
Soft teeth	27	30	72	26	29	55	5	9	25
Empty spaces, where teeth were pulled	36	14	36	25	59	69	8	5	43
Sharp teeth	34	36	48	44	28	13	17	29	26
Teeth full of fillings	24	25	2	24	64	28	50	40	36
Decayed teeth	39	17	24	32	47	58	3	9	55
Buck teeth	45	42	45	53	20	8	5	15	41
False teeth	23	28	—	7	58	74	40	33	25
Crooked teeth	41	25	57	55	22	19	7	11	44
Knocked-out teeth	58	9	59	59	22	20	4	6	52
Biting teeth	43	49	53	43	20	10	16	22	19
Straightened teeth	12	37	28	78	18	3	50	58	8

people are prone to make broad and inclusive judgments of others: what they are like, what type of personality they have, what their appearance is, the type of care the individual gives to himself, notions of whether such a person would be pleasant to be with or not, sexual definitions, and the like.

Implicit in these images are many value judgments: the "pretty girl," "careful person," "cocky fellow," "unhealthy person," and the like are not only descriptive—they are objects which people like or dislike, desire or shy away from, seek to emulate or hope to avoid. Also, they carry with them many cultural meanings pertaining to how we reward people in our society—the "good looker" who is loved, popular, sexy, glamorous, or the "obnoxious sort of person" who is isolated and avoided, without friends and with little chance of success in his personal or occupational life.

The sharp social definitions people make on the basis of teeth are even more evident in Tables 2 and 3. Respondents were presented with a list of various occupational, sex and age categories (Table 2) and with a second list containing various personality characteristics (Table 3). Interviewers read to them descriptions of teeth, and for each description they were asked to select the three people from each list "who would most likely have these kinds of teeth."[2]

These tables contain many interesting results, which will be referred to at various points in the report. Here it can be pointed out that teeth have social definitions, and that different types of teeth (and dental care) are considered more appropriate with various types of social and personal characteristics.

For example, "yellow teeth" are associated with men and lower status people (factory workers); they are suggestive of infancy, and signify a commonly held idea that "baby" teeth need not or are not cared for with great regularity; and emphasize the notion that as people get older their teeth get less attention (as also reflected in the response to "teeth full of fillings" and "false teeth"). "White teeth" imply higher social status, younger age, and women. Dental de-

2. Because three answers were selected, the percentage figures in the accompanying tables add up to approximately 300 per cent. The "don't know" answers account for the variations of the total per cent from 300 per cent.

Table 3 • Personality traits selected on the basis of descriptions of teeth (in %; N=116)

	Confident person	Mean person	Quiet person	Friendly person	Active person	Pretty person	Healthy person	Successful person	Unhappy person
Yellow teeth	9	81	45	9	34	3	4	8	90
White teeth	60	3	12	41	14	70	62	34	2
Soft teeth	10	41	63	27	29	12	5	19	62
Empty spaces where teeth were pulled	16	58	43	22	45	1	14	17	71
Sharp teeth	36	50	21	16	47	14	34	20	31
Teeth full of fillings	49	18	28	29	41	19	25	49	23
Decayed teeth	12	66	56	16	34	3	4	11	80
Buck teeth	12	48	51	31	22	3	19	15	67
False teeth	50	16	35	30	34	28	22	47	19
Crooked teeth	12	65	51	27	32	4	8	14	65
Knocked-out teeth	13	80	16	7	68	1	14	12	75
Biting teeth	33	37	19	21	42	17	41	28	34
Straightened teeth	53	1	14	34	25	59	41	52	3

formities (as in "buck teeth," "crooked teeth," "knocked-out teeth," and "biting teeth") typically are associated with youthfulness and lower social status, as well as with men more than with women. Women are generally regarded as giving more care to their teeth, especially insofar as appearance is concerned—a reference to the feeling that teeth are an important part of an individual's appearance and hence women would be more apt to seek corrections and improvement in their dental appearance. Similarly, higher status people are thought of as being more likely to correct the appearance of their teeth, as are younger people ("18 year old").

In Table 3 other definitions of teeth are revealed, the more noteworthy of which are:

yellow teeth - - unhappy person, mean person

white teeth - - pretty person, healthy person, confident person

soft teeth - - quiet person, unhappy person

empty spaces - - unhappy person, mean person, active person, quiet person

sharp teeth - - mean person, active person, confident person, healthy person

teeth full of fillings - - successful person, confident person, active person

decayed teeth - - unhappy person, mean person, quiet person

buck teeth - - unhappy person, quiet person, mean person

false teeth - - confident person, successful person

crooked teeth - - unhappy person, mean person, quiet person

knocked out teeth - - mean person, unhappy person, active person

biting teeth - - healthy person, mean person

straightened teeth - - pretty person, confident person, successful person

The afore-mentioned results reflect on only some of the social and personal meanings of teeth; certainly there are many more which would be important to discern in any future investigation of this sort. But even these limited meanings focus on an important issue, namely, that teeth and dental care are not limited to

their functional use or their essential character. They also serve as symbols of a total person—personality, appearance, social status, age, sex—and that these considerations are of consequence in motivating people to care for or to neglect their teeth.

Teeth as a "Self Measure" • Teeth are not only external symbols; people also use their teeth to find out and to "keep track," as it were, about themselves. Two very common assumptions about teeth indicate how this is done: one is that teeth refer to the general state of health of a person and they are symbolic of a person's age.

In regard to health, people are inclined to believe that teeth indicate "something" about one's forebears—for as will be discussed later, "teeth and dental trouble are inherited."

> Now take my family. I have had more trouble with my natural teeth than any of my sisters. My mother had children just as fast as she could. I was the last one and she died when I was seven weeks old, and I don't think I had a good start. The last two children didn't have a good start. My sister who is 71 has good teeth now; the two younger ones have had trouble. I just say that there wasn't much left over when she got to me . . .
>
> (UL, 58, Woman)[3]

This woman uses her teeth as a means of focusing on many of her feelings about her mother, sibs, and childhood environment; in her mind, if our interpretation of her remarks is correct, it was her mother who deprived her of "good teeth," whereas it was her mother who endowed her older sister with a sound set of teeth. This type of psychic use of teeth is by no means uncommon, for teeth are convenient and visible objects on which to attach significant feelings about oneself, one's childhood, one's parents and environment.

In a similar manner people think of teeth as signifying a more general state of health—namely, that sound, healthy teeth denote a sound, healthy body, and conversely that soft, decayed teeth are indicative of other possible body ailments. Some individuals think of dental trouble as indicating an impending, more serious ailment or illness, as if teeth were more sensitive than other parts of the body. Also, there is a very widespread belief that teeth and dental care are related to eating and dietary habits, and that good teeth refer to proper foods and indulgent care, higher status families with money and the concern to take care of teeth at an early age.

As for age grading, teeth serve as excellent symbols. The infant grows teeth: it is a very visible and tangible evidence of his maturation. The child loses his deciduous teeth and begins to get his second teeth: he is on his way to becoming a young person. The teen-ager is sensed to be more concerned with his teeth: the social meanings of teeth come to the fore at this period of life when relations with other people increase and become elaborated. Decay, too, suggests growth and maturation; decay also suggests aging in its more negative sense: getting old, losing strength and vitality, becoming less attractive and perhaps less concerned with appearance. And losing teeth, at least among some groups and when thought of in its more stereotyped aspects, indicates old age, physical disabilities, the loss of natural energies, and the need for artificial substitutes. In all of these ways, as shown in the previously cited tables, teeth are important to people.

Teeth Require Care • A further assumption people make about teeth is that they must be taken care of, and implicit in this is that teeth inevitably cause trouble, decay, become painful, fall out or have to be pulled.

In some respects the idea that teeth need to be cared for—and the assumption here is that if not cared for they will

3. These quotations are identified by the sex, age and social class placement of the respondent.

cause even more trouble—is expressed most forcefully and in the least conscious manner in completions to the sentence stem: "The most important thing about teeth . . ." With little variation respondents define this stimulus in terms of caring for teeth, as when they say:

. . . is brushing them.
. . . is care.
. . . to keep them clean.
. . . to keep them in good shape.
. . . is the proper diet, but prenatal care has something to do with it.

More often than thinking about teeth in terms of pleasures and gratifications, this suggests they are thought of in terms of pain, trouble, problems, and care. This has many implications, as will be referred to later, but this attitude forcefully brings to the fore the notion that teeth in many ways are a nuisance, that any rewards or pleasures from teeth are hard to come by and then only when a person invests time, energy, and money in caring for them.

This attitude toward teeth reflects a more general attitude that pervades our middle class culture. It is based on the premise that rewards, gratifications, and pleasures must be earned, worked for; it reflects the idea that many parts of the body are "evil" or troublesome, and that only by being clean, good, wholesome will trouble be postponed or, most hopefully, avoided. As will be pointed out later, the dominance of this feeling that teeth need to be cared for in many ways helps us understand why many people neglect their teeth, why some people care for them in overly vigorous and compulsive ways (perhaps to the point of harming them), and why not a few people feel that false teeth have many advantages over natural teeth.

"Brushing Is the Thing!" • Care tends to be synonymous with brushing: brushing is agreed to be the most important thing to do with and for teeth. Even those in our sample who do not brush their teeth (and there are a few who say they very seldom brush) agree with this maxim of dental care—and of course, the majority of respondents who follow some regimen of dental care tacitly acknowledge the importance and value they place on brushing by their own, personal habits.

I brush my teeth after breakfast and after lunch on week days and after supper. On weekends just twice, because I don't eat breakfast.

(LM, 17, Boy)

I just brush the ones I got—seven of my own and then partial plates for the rest. I just brush once a day. If I work nights I brush them when I get home, and if I work days I brush them when I get home. It just depends on when I get home from work.

(UL, 47, Man)

Well, I guess we're not normal, but I even make Louise [daughter] take a tooth brush to school. Believe it or not, when we eat at a restaurant we all go to the washroom and brush our teeth. I think a clean mouth is so important, I even made my husband come back in the house and brush his teeth because he had forgotten.

(LM, 38, Woman)

These comments were made when we asked, "What care do you take of your teeth?", and suggest the way in which care is defined as brushing. There is some evidence in the data that dental care is overly defined as brushing, that this single procedure serves to limit awareness of other (and perhaps more pleasant and more important) types of care.

It is of interest that people assume that the more frequent and the more vigorous the brushing the better it is. People who "really" take care of their teeth brush them "many" times a day, so this view holds, and use "strong" brushes and cleaning agents. The logic here is that the more often teeth are cleaned and the more powerful the brushing, the "better" it is. This view is not confined to natural teeth; in fact, it is expressed most clearly by those who have false teeth, several of whom use scouring powders and detergents:

I don't have to take care of my teeth because they're false. But you know what I do? I scrub my false teeth with Ajax. It gets 'em real clean. Then I use toothpaste so it'll feel and taste clean in my mouth . . .

(LL, 37, Woman)

Comments such as these, when considered in connection with other attitudes people have about their mouths and teeth, suggest that dental care is often defined as a way to clean a "dirty" part, that teeth are in some way symbolic of "sin," and that brushing, rather than mainly being a preventive measure or pleasurable activity, also reflects on an attempt to atone, to purify, to become good. It is in this framework that remarks such as the following take on additional meaning and significance:

I'd tell him he should brush his teeth three times a day, use a strong, vigorous motion and at the same time hit the gums good. Use a mouth wash—I'd tell him it kills germs. I'd tell him if he didn't he'd have to get his teeth pulled and have to have false ones; they're not as nice as the original ones.

(LM, 40, Man)

These instructions are intended for a four or five year old child, and were made in response to the question, "I'd like you to pretend that you are teaching a four or five year old child how to take care of his teeth, and explaining why he should take care of them. What would you say to him and what would you show him?" While not all people are so explicit in their references to this vigorous (and in some ways punishing) type of dental care, the same themes appear in many of the interviews, and refer to other important meanings people attach to teeth and dental care.

Preventive Dentistry Is Limited; the Dentist Is Often the Last Resort • Much of the afore-mentioned alludes to the fact that people tend to have a limited understanding of teeth and dental matters which influences the type of dental care they seek or desire. This is perhaps most apparent in connection with attitudes toward dentists, and in this exploratory study we find that dentists are more closely associated with the "final stages" of dental problems than with preventive measures.

There are important exceptions to this generalization, but it nevertheless tends to be an over-all attitude that "dentists fix teeth that already are painful, decayed, or need to be pulled." In many respects this attitude is contrary to very explicit statements repeatedly made that dentists should be seen once or twice a year—another maxim which almost everyone is aware of and responds with in these interviews, whether personally followed or not. Thus, a lower middle class, 17 year old boy completes the sentence stem "Going to the dentist . . ." with the phrase "should be done twice a year." But when asked what his experiences with dentists have been, the boy says:

Back in Boston when I was five a front tooth came out and I had to have braces to keep the teeth apart. I only go when it's necessary, when I have cavities or a toothache. I went about a year and a half ago and had a tooth pulled.

Other comments reflecting the same theme are:

I go just when I have a toothache and have to go. It's been about six or eight years since I went. [This man, too, tells us that "going to the dentist . . . should be twice a year."]

(LM, 50, Man)

I just go when I have to or have a toothache. It's been about eight years now. He was a pretty good dentist, tall, middle aged, very gentle in extracting. He was interested, but he didn't have too much to say. I had six pulled at one time. [And this woman says, "Going to the dentist . . . is a must."]

(UL, 37, Woman)

Of course, not all people postpone their visits to the dentist until they experience pain; there are those who go every six or 12 months for a dental check-up regardless of how their teeth feel, though they are in a minority. But more generally, pain is the determining factor: a

toothache indicates that now is the time to see a dentist, with the implicit notion being that dentists stop pain more than (and in many instances, in place of) prevent it. They are, in effect, the last resort —the professional person one sees when delay is no longer possible, when the problem is so far gone that it cannot be solved by the individual, himself, but instead requires the skill of a trained person. And it carries with it the implication that the main expectation of dentists is to repair teeth, by either filling or extracting, and that dentists are not typically thought of as someone who can help people ward off dental problems.

COMMENT

These, then, are a few of the common meanings people associate with teeth and some of the more pronounced attitudes they have about dental care in its personal and professional realms. In subsequent chapters we elaborate these findings and discuss further some of the reasons why people care for or neglect their teeth.

COUNCIL ON INTERNATIONAL RELATIONS

The Fédération Dentaire Internationale

More than 1,400 members of the American Dental Association are taking advantage of the opportunity to broaden their professional experience by work and travel in the field of international dentistry through membership in the Fédération Dentaire Internationale, the international organization of the dental profession.

The Fédération, with headquarters in London, is the only international organization in the dental profession which is a federation of national dental societies in all parts of the world. More than 50 national dental societies, including the American Dental Association, now hold membership in the Fédération.

In order to permit individual dentists to participate in the program of international dentistry, the Fédération Dentaire Internationale has a classification of "supporting membership" which is available to all members in good standing of a member national association.

Benefits of supporting membership in the Fédération Dentaire Internationale include: (1) a beautifully engrossed membership certificate suitable for framing; (2) an annual pocket membership card; (3) an annual subscription to the *International Dental Journal,* a scientific publication issued quarterly; (4) an annual subscription to the *FDI News Letter,* a quarterly publication with news items of dentistry around the world. In addition, membership in the F.D.I. provides access to dental meetings in many parts of the world, including F.D.I. annual sessions and the quinquennial congresses.

Those planning to attend the annual meeting in Brussels, Belgium, August 27 to September 2, may contact C. W. Carrick, Oberlin Bank Bldg., Oberlin, Ohio, for travel and hotel reservations. Dr. Carrick is travel consultant for F.D.I. members in the United States.

For the convenience of dentists who wish to join the Fédération Dentaire Internationale, an application form is printed on page A-62 of this issue. It should be filled out and mailed to the national treasurer for the F.D.I. (United States), Obed H. Moen, 6 Main St., Watertown, Wis.

BUREAU OF LIBRARY AND INDEXING SERVICE

Additions to the Library

The books listed here have been added recently to the Library collection. Requests for this material, available on loan to all members of the Association, should be addressed to the Bureau of Library and Indexing Service. There is no charge for borrowing these books. Most of these books may be purchased also through the Bureau. In addition practically all the dental journals published in the world at present are available to members on loan.

BOOKS

AMERICAN DENTAL ASSOCIATION. American dental directory 1958. Chicago, 1958. 1,187 p. $15.

AMERICAN DENTAL ASSOCIATION. BUREAU OF LIBRARY AND INDEXING SERVICE. Index to dental literature in the English language 1957. Chicago, 1958. $10.

AMERICAN DENTAL ASSOCIATION. COUNCIL ON DENTAL EDUCATION. Education and certification of dental assistants; workshop, October 2-4, 1957. Chicago, 1957. Collection of 10 Mimeographed papers.

AMERICAN DENTAL ASSOCIATION. COUNCIL ON DENTAL THERAPEUTICS. Accepted dental remedies; drugs used in dental practice including a list of brands accepted by the Council on Dental Therapeutics of the American Dental Association. 23d ed. Chicago, 1958. 214 p. $3.

BRANDAU, PAUL & BRANDAU, IRMGARD. Die Perlon-Armierung in der zahnärztlichen Kunststoffprothetik. Berlin, Berlinische Verlagsanstalt, 1956. 88 p.

COMMISSION ON CHRONIC ILLNESS. Chronic illness in a large city; the Baltimore study. (Chronic illness in the United States, Vol. 4.) Cambridge, Mass., Harvard Univ. Press, 1957. 620 p. $8.

EUROPEAN ORGANIZATION FOR RESEARCH ON FLUORINE AND DENTAL CARIES PREVENTION. Proceedings of the 4th Congress, June 14th-17th, at Malmö, Sweden. Edited by Odontologisk Revy. Lund, 1957. 280 p.

FORTSCHRITTE DER KIEFER- UND GESICHTS-CHIRURGIE; ein Jahrbuch. Edited by Karl Schuchardt. Vol. 3. Stuttgart, Thieme, 1957. 359 p. $22.85.

HENSHAW, R. C. & CASBERG, M. A. Illustrative model projection of dentist population; a preliminary study in the State of Texas. Austin, Univ. of Texas, 1957. 40 p. Mimeo.

HERON, W. T. Clinical application of suggestion and hypnosis. 3d ed. Springfield, Ill., Thomas, 1957. 165 p. $3.75.

LANGELAND, KAARE. Tissue changes in the dental pulp; an experimental histologic study. (Also published in Odontologisk Tidskrift, Vol. 65, No. 4, 1957.) Oslo, Oslo Univ. Press, 1957. 146 p.

MARSHALL, M. L. The physician's own library; its development, care and use. Springfield, Ill., Thomas, 1957. 87 p. $3.

MÉNDEZ RIBAS, JOSÉ. La asistante dental en función. Buenos Aires, Editorial Mundi, 1957. 482 p.

NEW YORK. CITY. BOARD OF ESTIMATE. Public hearing on the question of fluoridation of New York City's water supply, March 6, 1957; transcript of the stenographic record. New York, 1957. 559 p. $279.50.

PARULA, NICOLÁS. Clínica de operatoria dental. Buenos Aires, Organización Dental Argentina, 1956. 410 p.

PHYSICIAN'S FEDERAL INCOME TAX GUIDE; for the preparation of 1957 returns and 1958 estimates, by Hugh J. Campbell and James B. Liberman. Edited by Henry D. Shereff. Great Neck, N. Y., Channel Press, 1957. 94 p. $2.50.

ROCHESTER. UNIVERSITY. DENTAL RESEARCH FELLOWSHIP PROGRAM. 25th year celebration, October 8th, 1955; proceedings dedicated to George Hoyt Whipple. Rochester, N. Y., Univ. of Rochester, 1957. 217 p.

SASSOUNI, VIKEN. Palatoprint, physiprint, and roentgenographic cephalometry, as new methods in human identification (preliminary report). (Journal of Forensic Sciences, Vol. 2, No. 4.) Chicago, 1957. 15 p.

SE HON, THE. Über die elastische, gelenkige und elastischgelenkige Verankerung von doppelseitigen Freiendprothesen. Inaugural-Dissertation. Bonn, 1955. 123 p.

STOWELL, C. H. The microscopic structure of a human tooth together with some unusal and irregular forms of teeth. Ann Arbor, The Author, 1887. 19 p.

STRÖMGREN, H. L. Skandinavisk Tandlaegeforenings historie 1866-1941. Copenhagen, Munksgaard, 1941. 152 p. $2.25.

WALSH, J. P. A manual of stomatology. Christchurch, New Zealand, Peryer, 1957. 130 p. $6.

COUNCIL ON DENTAL THERAPEUTICS

Council announces classification of additional products

The classification of products by the Council on Dental Therapeutics has been described in a previous report (J.A.D.A. 40:489 April 1950). The Council's program now provides for classification of products in Group A, Group B, Group C and Group D. Products are reconsidered periodically, and decisions are subject to change at any time that a substantial amount of new evidence becomes available. The files of the Council contain information on many drugs and dental cosmetics, and inquiries are welcome.

GROUP A

Listing of products in Group A means that at the time of their consideration, the items conformed with the provisions for acceptance established by the Council on Dental Therapeutics and adopted by the Board of Trustees and the House of Delegates of the American Dental Association. Items in this group will be listed in *Accepted Dental Remedies*, and may use the Seal of Acceptance, unless otherwise provided.

The following additional products are classified in Group A:

Benzalkonium Chloride, U.S.P. (See A.D.R. 1958, p. 92)

Lawco Chemical Disinfecting Solution (L & W Manufacturing Company): Each 100 ml. is stated to contain benzalkonium chloride, 100 mg.; sodium nitrite, 100 mg.; color and water.

Penicillin V (See A.D.R. 1958, p. 67)

Compocillin-V Oral Suspension, 180 mg. (300,000 Units) per 5 cc. (Abbott Laboratories): Each 5 ml. is stated to contain penicillin V as hydrabamine salt, 300,000 units, in an aqueous suspension with thickening agents, color, and non-sugar flavoring agents. Marketed in 80 ml. bottles.

V-Cillin Pulvules, 125 mg. (200,000 Units) (Eli Lilly and Company): Stated to contain penicillin V and excipients.

V-Cillin Pulvules, 250 mg. (400,000 Units) Eli Lilly and Company): Stated to contain penicillin V and excipients.

Chloramine-T, N.F. (See A.D.R. 1958, p. 101)

Nuklorene (Chloramine-T) 4.6 grain Tablets (Stratford-Cookson Co.): Each 100 Gm. is stated to contain chloramine-T, 92 Gm. and sodium chloride, 8 Gm.

Eugenol, U.S.P. (See A.D.R. 1958, p. 109)

Eugenol-Marvel Brand (Reliable Dental Supply Co.): A brand of eugenol, U.S.P. Marketed in 1 oz. bottles.

Eugenol (National Dental Supply Co. of New York): A brand of eugenol, U.S.P. Marketed in 1 oz. bottles.

Proco-Sol Chemical Company, Inc.

Proco-Sol Chemical Company's brand of the following official preparations, currently described in *Accepted Dental Remedies*, 1958, have been classified in Group A:

Formaldehyde Solution, U.S.P.
Chloroazodin Solution, N.F.
Tincture of Iodine, U.S.P.
Strong Iodine Tincture, N.F.
Nitromersol Tincture, N.F.
Hydrogen Peroxide Solution, U.S.P.
Camphorated Parachlorophenol, N.F.
Cresol, U.S.P.
Creosote, N.F.
Eugenol, U.S.P.
Ammoniacal Silver Nitrate Solution, N.F.

Epinephrine Solution 1:1,000, U.S.P.
Tannic Acid Glycerite, N.F.
Sodium Fluoride, U.S.P.
Calcium Hydroxide, U.S.P.
Glycerin, U.S.P.
Clove Oil, U.S.P.
Menthol, U.S.P.
Chloroform, U.S.P.

The following additional products, marketed by Proco-Sol Chemical Company, Inc., have been classified in Group A:

Antiseptics and Germicides for Topical Application (See A.D.R. 1958, p. 97-114)

Iodine Disclosing Solution (Skinner): A preparation stated to contain iodine, 8.9 per cent; zinc iodide, 2.7 per cent; potassium iodide, 2.7 per cent; glycerine, 42.9 per cent, and distilled water.

Liquefied Parachlorophenol: Stated to contain not less than 98 per cent parachlorophenol and approximately 2 per cent glycerine.

Parachlorophenol with Camphor: Each 100 Gm. is stated to contain parachlorophenol, 25 Gm.; camphor, 45 Gm.; liquid petrolatum, 30 Gm.

Benzalkonium Chloride Solution 12.8%: Stated to contain benzalkonium chloride, 12.8 per cent; water, 87.2 per cent. This is a concentrated dosage form, intended for dilution with distilled water to produce a 1:1,000 solution of benzalkonium chloride.

Silver Nitrate Solution with Ammonia: Each 100 Gm. is stated to contain the equivalent of approximately 7.5 Gm. of silver and 2.5 Gm. of ammonia.

Vasoconstrictors and Hemostatics (See A.D.R. 1958, p. 123)

Tannic Acid Solution, 20 per cent: A solution of tannic acid, 20 per cent by weight.

GROUP B

Listing of products in Group B means that there is insufficient evidence to justify their present acceptance, but there is reasonable evidence of their usefulness and safety. These products meet the other qualifications and standards established by the Council on Dental Therapeutics. It is the Council's opinion that Group B products may be promoted for special use and study.

The Council's initial consideration of products which may be eligible for Group B listing is influenced favorably by the knowledge of further investigations then in progress. It is the policy of the Council to reconsider Group B products each year on the basis of new evidence which may be produced in their support. Classification in this category is not ordinarily continued for more than three years.

The following additional products are classified in Group B:

Metabutoxycaine Hydrochloride (See A.D.R. 1958, p. 28)

Primacaine Hydrochloride (Novocol Chemical Mfg. Co., Inc.): A brand of metabutoxycaine hydrochloride.

Primacaine HCl 1½%, Epinephrine 1:125,000: Each ml. is stated to contain metabutoxycaine HCl, 0.015 Gm.; epinephrine, 0.000008 Gm.; sodium bisulfite, 0.0015 Gm.; sodium chloride, 0.0045 Gm.; calcium disodium ethylenediaminetetraacetate, 0.0005 Gm.; distilled water, q.s. Marketed in 1.9 ml. tubes.

Primacaine HCl 1½%, Epinephrine 1:60,000: Each ml. is stated to contain metabutoxycaine HCl, 0.015 Gm.; epinephrine, 0.000017 Gm.; sodium chloride, 0.0015 Gm.; sodium bisulfite, 0.0015 Gm.; calcium disodium ethylenediaminetetraacetate, 0.0005 Gm.; distilled water, q.s. Marketed in 1.9 ml. tubes.

GROUP C

Listing of products in Group C means that the evidence is so limited or inconclusive that the products cannot be accurately evaluated. It is the Council's opinion that Group C products require further study by qualified investigators.

GROUP D

Listing of products in Group D means that they are unacceptable because of their demonstrated inability to meet the standards outlined in the provisions for acceptance.

COUNCIL ON LEGISLATION

Taxpayers' right to deduct dental and medical expenses

In 1957, the House of Delegates of the Association adopted a resolution "that federal and state governments be requested to declare the payment of all dental and medical expenses as casualty losses and, as such, tax deductible."

FEDERAL LAW

Under existing law (Sec. 213, IRC, 1954), the deduction for medical and dental expenses is limited to the amount by which such expenses exceed 3 per cent of the taxpayer's adjusted gross income. (This is not applicable to taxpayers and spouses age 65 or over.) In addition, in arriving at the deductible amount, (1) only the amount spent for drugs and medicine which is in excess of 1 per cent of adjusted gross income may be taken into account (see example 3), (2) medical and dental expenses compensated by insurance may not be deducted and (3) in no case may the deduction exceed $10,000 for a joint return taxpayer, head of household, and so on, or $5,000 for an unmarried taxpayer. The effect of these provisions is illustrated in Internal Revenue Regulations by the following examples:

1. H and W having one dependent child had adjusted gross income for 1956 of $3,000. During 1956, H paid $300 for medical care of which $100 was for treatment of his child and $200 for an operation on W. He received a payment of $50 for health insurance on account of W's operation. If H itemizes his deductions, his medical expense deduction is $160 computed as follows:

Payment for medical care	$300
Less: insurance	$ 50
	$250
Less: 3% of $3,000 (adj. gross income)	$ 90
Amt. allowable as deduction	$160

2. Same facts as in (1) except that H's adjusted gross income is $8,000. H's medical expense deduction is $10 computed as follows:

Payment for medical care	$300
Less: insurance	$ 50
	$250
Less: 3% of $8,000 (adj. gross income)	$240
Amt. allowable as deduction	$ 10

3. T had adjusted gross income of $6,000. He paid $300 for medical services, $100 for hospital care and $100 for medicine and drugs (not compensated by insurance). His deduction is $260, computed as follows:

Physician		$300
Hospital		$100
Medicine and drugs	$100	
Less: 1% of $6,000 (adj. gross income)	$ 60	
		$ 40
		$440
Less: 3% of $6,000 (adj. gross income)		$180
Amt. allowable as deduction		$260

It is apparent that removal of limitations in existing law would, on an individual basis, be of most benefit to taxpayers with substantial incomes. For instance, in the examples above, if the 3

per cent restriction were eliminated, the taxpayer in (1), with an income of $3,000, would increase his deduction by only $90 whereas the taxpayer in (2), with an income of $8,000, would increase his by $240. However, on an over-all rather than an individual basis, it is likely that a major portion of the tax benefit would go to low and middle income taxpayers since the vast majority (97 per cent) of all taxpayers are in those categories. But, the proposal's application to the latter group will be somewhat limited since many taxpayers in the low and middle income brackets are removed from the practical application of any provision regarding the deduction of dental and medical expenses because of the requirement that in order to deduct such expenses, a taxpayer must itemize all of his deductions. This means that a dental and medical expense deduction is of no value and would not be used by an individual unless the total of his deductions exceeds the "standard" deduction of the lesser of $1,000 or 10 per cent of gross income.

In any case, it is difficult to single out any particular class of taxpayers which derives most benefit from the allowance of deductions for dental and medical expenses. The chief beneficiaries are individuals who have the misfortune to suffer serious injuries or illnesses entailing the expenditure of large sums of money for dental or medical care.

STATE LAW

Because of the lack of uniformity of state income tax laws, it is difficult to generalize concerning provisions governing deduction of expenses for medical and dental care. However, most states having income tax laws have made some provision covering the deduction of such expenses. A complete state by state compilation is appended hereto. In summary, it may be noted that 18 states do not levy taxes on individual incomes. Of the remaining states, 12 allow a basic deduction for medical expenses of the amount by which such expenses exceed 5 per cent of a taxpayer's adjusted gross income up to a maximum of $2,500 for joint return taxpayers and $1,250 for single taxpayers. Six states follow the federal pattern and allow a deduction of the excess of 3 per cent of adjusted gross income. Six states do not permit deductions for medical and dental expenses. Two states, Minnesota and North Dakota, permit unlimited deduction of such expenses. One state, Arizona, permits deduction of all medical expenses up to $5,000 for joint return taxpayers and $2,500 for other taxpayers. Four states permit deduction of expenses in excess of a flat dollar amount which ranges from $50 in Kansas, and $75 in Wisconsin, to $100 in Idaho and in Oklahoma.

Under state laws, as under the federal law, individuals in the higher income brackets would stand to gain more from removal of limitations on the deductibility of dental and medical expenses than would those in low or middle income brackets. Again, however, in terms of total benefit, the latter groups also would gain substantially.

The amount of revenue which might be lost to the states as a result of removal of present limitations is difficult, if not impossible, to estimate. Minimizing factors would be the alternative "standard" deduction available under most state statutes and relatively large exemptions found in many state laws.

CONCLUSIONS

Although recognizing that only a limited number of taxpayers would benefit to any great extent from legislation incorporating the Association's resolution, it is believed that the objective is meritorious and worthy of active support. Certainly, no individuals more deserving of tax re-

lief could be found than those faced with medical catastrophe. In addition, it is entirely possible that legislation of this type might encourage more people to seek and obtain adequate dental and medical care and thus in some measure raise the standard of health among the general public.

Deduction of dental and medical expenses under state income tax laws (Source: Commerce Clearing House)

State	Amount deductible	Maximum	
		Joint	Single
Alabama	In excess of 5% of gross income	$2,500	$1,250
Arizona	Up to maximum	$5,000	$2,500
Arkansas	In excess of 3% of gross income	$10,000	$5,000
California	In excess of 5% of adj. gross income	$2,500	$1,250
Colorado	In excess of 5% of adj. gross income	$2,500	$2,500
Conn.	No income tax		
Delaware	In excess of 5% of adj. gross income	$5,000	$2,500
Florida	No income tax		
Georgia	In excess of 5% of adj. gross income	$2,500 (+ $1,250 ea. dependent)	$1,250
Idaho	In excess of $100		
Illinois	No income tax		
Indiana	No provision in gross income tax law		
Iowa	Same as federal law		
Kansas	In excess of $50		
Kentucky	Same as federal law		
Louisiana	None		
Maine	No income tax		
Maryland	In excess of 3% of adj. gross income	$2,500	$1,250
Mass.	None		
Michigan	No income tax		
Minn.	All		
Miss.	No provision in gross income tax law		
Missouri	In excess of 5% of adj. gross income	$2,500	$1,250
Montana	Same as federal law		
Nebraska	No income tax		
Nevada	No income tax		
New Hamp.	None		
New Jersey	No income tax		
New Mexico	None		
New York	In excess of 3% of net income not exceeding $6,000; in excess of 5% of net income exceeding $6,000	$2,500	$1,250
N. C.	In excess of 5% of net income	$5,000	
N. D.	All		
Ohio	No income tax		
Oklahoma	In excess of $100 for single person; In excess of $200 for joint return taxpayer	$1,500	$750
Oregon	In excess of 5% of adj. gross income	$5,000	
Pa.	No income tax		
R. I.	No income tax		
S. C.	In excess of 5% of adj. gross income		
S. D.	No income tax		
Tenn.	No general income tax		
Texas	No income tax		
Utah	In excess of 5% of gross income	$1,500	$750
Vermont	Same as federal law		
Virginia	In excess of 5% of adj. gross income	$5,000	$2,500
Wash.	No income tax		
W. Va.	No income tax		
Wisc.	In excess of $75	$1,500	
Wyo.	No income tax		
Dist. of Col.	In excess of 5% of adj. gross income	$2,500	$1,250

Book Reviews

CLINICAL OPERATIVE DENTISTRY

By William John Simon, D.D.S. 381 pages with 650 illustrations. Index. $9.50. Philadelphia, W. B. Saunders Co., 1956.

Forty-five persons have contributed to this book. The text is composed of six chapters: Guides to Operative Dentistry, Amalgam Restorations, Inlay Restorations, Silicate Cements, Acrylic Resin Fillings and Gold Foil Restorations. A generous bibliography is appended to each chapter except the first one. A discussion of ceramic restorations has been omitted because these restorations most frequently are porcelain jacket crowns and are dealt with in textbooks on crown and bridge.

Dr. Simon's style of writing is clear, a skill of special value in describing technical processes in operative procedures. The author approaches his subject directly and does not waste words in his descriptions. It is a pleasure to recommend a book that shows such a broad grasp of the subject and which presents the theories of so many previous writers.

The author is to be commended on the painstaking care with which he has prepared his material. He has produced a most creditable volume. The book is particularly well illustrated, and the mechanical make-up worthy of praise. Both author and publisher are to be congratulated on the result. The reviewer feels that this book will serve both the student and practitioner who desire to review operative procedures.

E. Alan Lieban

ORAL HYGIENE

By Russell W. Bunting, D.D.S., D.D.Sc., D.Sc., and collaborators. Third edition, 334 pages with 233 illustrations. Index. $7. Philadelphia, Lea & Febiger, 1957.

As indicated in the preface, this textbook provides training for dental hygienist students in oral hygiene. Dr. Bunting has defined oral hygiene broadly to include "all those conditions which contribute to the health of the mouth, that is, preventive dentistry."

The author has been fortunate in obtaining the collaboration of recognized authorities who have contributed chapters on anatomy, embryology, and physiology of the face and oral structures, dental caries, periodontal diseases and stomatitis. Similarly oral prophylaxis, the role of the hygienist in public health, dental health education and the history of dental hygiene are expertly reviewed.

This volume has merit, not only as a textbook for students but also as a reference for general practitioners, dentists and dental hygienists.

Two new chapters by members of the dental hygiene profession are a special feature of this third edition.

J. M. Wisan

COSTS OF ATTENDING COLLEGE

By Ernest V. Hollis and Associates, College and University Administration Branch, Division of Higher Education, U. S. Department of Health, Education, and Welfare. 91 pages with 29 charts and tables, bibliography, and three appendix exhibits. 45c. Washington 25, D.C., U. S. Government Printing Office, 1957.

The entering college freshman, during the 1956-57 school year, will spend between $1,500 and $2,000 per year for the four years usually needed to earn the B.A. degree. His counterpart of 1940 spent only half this amount for essentially the same commodity. This fact alone, and indeed the whole array of enlightening but sobering facts contained in this pamphlet, emphasizes the increasing concern of educators, government officials, and taxpayers at-large over the ever-higher price tag that is being attached to a college education.

The authors have surveyed 110 of our nation's 1,886 colleges and universities and polled, with a comprehensive questionnaire, more than 15,000 undergraduate students. The purpose, scope, observations, and high lights of this study are concisely presented and liberally illustrated with excellent charts and tables. The appendix exhibits offer the schedules used in gathering data and present an alphabetical list, by states, of the participating schools.

Some searching questions are raised and answered. A sample, "Is the public aware of the basic issue involved in full utilization of the brain power of the nation?", gives some idea of the scope and breadth of this brochure. It is perhaps in this single question that the authors have stated their theme and vindicated their efforts in what is clearly a most readable and important report.

The significance of this report to dental education is direct. The cost of predental

education, as this study indicates, may range from $3,000-$8,000. Currently, 45 per cent of the entering freshman dental students have baccalaureate degrees, and it can be assumed that these students have already met educational expenses of $6,000 to $8,000. To complete an additional four years of dental education will entail total educational expenditures of major proportions. Both students and educators will be vitally concerned with the implications of these figures for the future of dentistry.

Ben F. Miller III

DENTAL CLINICS OF NORTH AMERICA—PUBLISHED QUARTERLY—NOVEMBER 1957 ISSUE

TUMORS OF THE ORAL REGIONS

By Hamilton B. G. Robinson, D.D.S., M.S., consulting editor, in collaboration with 12 co-authors. 139 pages with illustrations. Index.

MODERN PRACTICE IN ENDODONTICS

By Robert G. Kesel, D.D.S., M.S., consulting editor, in collaboration with 14 co-authors. 139 pages with illustrations. Index. The two subjects are contained within the November issue. $14 yearly subscription. Philadelphia, W. B. Saunders Co., 1957.

The text of "Tumors of the Oral Regions," which is in the form of a symposium, brings together, graphically and pictorially, the wide experiences of renowned oral pathologists and prosthodontists. It is a brief and concise coverage of symptoms, physical signs, essential laboratory procedures, differential diagnosis and therapeutic schedule of each entity. The material is up-to-date, practical, clinically oriented and adequately illustrated. Each condition is analyzed thoroughly as to cause and principles to be observed. The editor has succeeded in preserving the many advantages of multiple authorship without obvious duplication.

The following topics are discussed: tumors of the lips, tongue, floor of the mouth, buccal and labial mucosa, palate, and gingiva; benign tumors and cysts of the jawbones; odontogenic tumors; primary and secondary malignant tumors of the jawbones; the treatment of oral cancer, and postsurgical prosthesis and prosthetic restorations of facial defects.

The work aims to provide the simplest and most direct avenue for learning and understanding tumors of the oral regions. It also furnishes excellent reference material.

Dental and medical practitioners as well as students should find this topic useful and interesting.

The section of the book, "Modern Practice in Endodontics," is a well written condensation of currently available information on this subject. It presents a practical and detailed symposium on the principles and procedures as related to endodontics.

Although this work represents the combined efforts of 15 contributors, skillful editing has produced a smoothness and unity that deserves commendation. The purpose of this work is to orient the student and general practitioner as to the proper approach to diagnosis of pulpal conditions and subsequent endodontic treatment. Descriptions of operative procedures conform to the best standards. The presentation is lucid.

The text quite naturally begins with a foreword by the guest editor, Dr. Kesel, and is followed by 12 chapters on the various phases of the subject. The teaching experiences of the authors are crystallized in this book, which provides an acceptable addition to the literature in this field. With but two exceptions, well chosen bibliographies are appended to each chapter.

The general practitioner should find much valuable information in this book.

E. Alan Lieban

A DICTIONARY OF SCIENTIFIC TERMS

By J. H. Kenneth, Ph.D. 532 pages. $12.50. Princeton, N. J., D. Van Nostrand Co., Inc., 1957.

This handy reference volume will undoubtedly prove useful to the student of science, provided that he is aware of its specified and unspecified limitations. The title is something of a misnomer, and to prevent even momentary misunderstanding, probably should have been "Dictionary of the Biological Sciences." Only such terms are included as fall within botany, biology, zoology, anatomy, cytology, genetics, physiology and embryology, as a lengthy subtitle indicates.

There are further limitations in coverage. The instrumentation of science is omitted, including such words as *microtome, microscope, scalpel, test tube,* and *centrifuge.* There are also no medical terms or terms pertaining to other of the health professions. Anatomy and physiology are represented abundantly, but all words relating to pathology are omitted as well as terms designating specific types of anomaly.

Obviously, this dictionary will have limited usefulness for the dentist. Dental histology and anatomy (especially comparative anatomy and

anthropology) are well represented. The nomenclature of dental physiology is far from adequately included. *Occlusion* is not defined in its dental sense, although *occlusal* as applied to the tooth surface is included. Other terms with a special dental sense are defined only in other specifications as with the term *mamelon*. Among the omission of dental terms are *alveolar process* (and in fact the general anatomical term *process* is also omitted), *cuspid*, *gingiva* (although *gingival* is given).

Tooth is omitted but *teeth* is included. And here the definition is open to objection: "Hard bony growths on maxillae, premaxillae, and mandibles of mammals; growths of similar, of chitinous, or of bony formation borne on jaws, tongue, or pharynx." In the definition of *cementum*, the identification as *crusta petrosa*, in this day and age, should be deleted.

The qualifications and criticisms given herein are not to be taken as serious reflections on the adequacy of this dictionary. For the biologist it may be excellent, and for the dental student, if he needs a dictionary as an aid to general science reading, this book will be useful and convenient. But for the dental literature outside the normal anatomical field, it will prove useless.

George B. Denton

QUANTITATIVE PHARMACEUTICAL CHEMISTRY

By Glenn L. Jenkins, Ph.D.; John E. Christian, Ph.D.; and George P. Hager, Ph.D. Fifth edition. 552 pages with 61 illustrations. Index. $8.50. New York, McGraw-Hill Book Company, Inc., 1957.

The problems involved in the essay of the pharmaceutical compounds and preparations listed by the United States Pharmacopeia and the National Formulary are discussed in this standard textbook. Its division into three sections separates the assays based upon the general principles of quantitative analysis from those employing physiochemical methods or the specialized technics of pharmaceutical analysis. This permits its use not only as a textbook for advanced courses in pharmaceutical assaying, but also for the basic course in quantitative analysis for pharmaceutical students.

The authors, in this fifth edition, have rewritten the text where necessary so that it might conform to the assays now recognized by the United States Pharmacopeia XV and the National Formulary X. Discussions of "Nonaqueous Titrations," "Chromatography" and "Radioactivity" have been added. Unfortunately these discussions, as well as the chapters on "Colorimetry" and "Spectrophotometry," fail to consider adequately the theories governing the use of these important analytical tools.

A number of new illustrations have improved the book which is handsomely printed and bound.

James E. Gearien

AN ATLAS OF HUMAN HISTOLOGY

By Mariano S. H. DiFiore, M.D. 215 pages with 99 color plates, 156 figures. Index. $7.50. Philadelphia, Lea & Febiger, 1957.

It is noteworthy that the illustrations of this atlas were made and printed in Buenos Aires. This is not surprising as the Spaniards have a long record of excelling in histology. The drawings are, for the most part, the work of one artist who appears familiar with the methods and technic of the architectural draftsman, even to using the method of projecting planes at an angle to the main drawing, especially in depicting vessels and glands. No photographs are used. The style is a trifle rigid and formal and each figure is a composite of several views or sections rather than a photographic reproduction of the original. Most of the illustrations are in color, and both the artist and the printer have succeeded admirably in their attempts to match the colors of the original specimens.

This atlas was produced solely to supplement a standard textbook and the services of an instructor. It will not appeal to the advanced student or specialist in this field. The selection of subject matter is excellent both as to amount and distribution, suitably divided between tissues and organs. The text is limited to a brief description of each figure. Up to this point the efforts of the author and his associates are to be highly commended. Unfortunately the text is marred by minor defects, either in proofreading or possibly in translation of an original text in another language. The index is more than adequate and the publisher has cooperated fully in producing an attractively bound and well made book.

Edward H. Hatton

Current Literature

QUICK DENTURE REPAIRS

Russell R. Burgess and Joseph A. Cantafio. J. South. California D.A. 25:41 Jan. 1957.

With newer self-curing acrylic resins any dentist is capable of making denture repairs in his own office in a minimum of time. A technic is described for meeting emergencies normally encountered in a dental office such as: (1) fractures in the denture base, (2) one or more teeth lost or broken from a denture, (3) the correction of a post-dam or peripheral extension, and (4) adding teeth to a partial denture.

The technic for applying the resin to the repair area may be varied considerably with equally good results. It is inadvisable in the use of any technic to wet the surface of the old acrylic resin with liquid before any powder or mix is added. Cleanliness is necessary, for contamination may result in poor bonding.

Self-curing acrylic resin, cured without pressure, is only 70 per cent as strong as heat-cured. However, it produces a repair free from warpage and one that is readily made and possesses sufficient strength to withstand the forces of mastication. The manner in which the fracture lines are prepared to receive the resin affects the ultimate strength of the repair. A V-joint provides greater strength than a butt-joint.

The use of self-curing acrylic resin enables the dentist to make a denture repair of excellent quality in a short time, thus rendering a better service to his patient.

VACUUM INVESTING AND THE USE OF A MODIFIED APPARATUS

Guy A. Morrant. D. Practitioner 7:246 May 1957.

Facts relative to the ways and means of eliminating nodules on castings due to trapped air-bubbles on wax patterns are demonstrated by the vacuum technic described for mixing casting investment materials. Microscopic examination of the castings developed with vacuum investing reveals this advantage conclusively.

The report is the result of investigation and work of a number of technicians. A variety of technics and various types of complex apparatus are described by which a simplified and modified method was developed to obtain the improvement.

Inadequate programs comprising the preliminary background work toward the prevention of rough castings led to reduced complications in the technic with improved apparatus.

Experimental equipment which brought about the vacuum investing method may be classified briefly: (1) conventional paint-on technic, (2) mechanical spatulating by hand, (3) vibration of the investment, (4) surface-tension reducers, and (5) vibration in combination with vacuum.

Vacuum investing routinely obtains a denser appearing surface as well as the elimination of nodules.

CERVICAL ANCHORAGE IN CLASS II, DIVISION I TREATMENT, A CEPHALOMETRIC APPRAISAL

Elbert W. King. Angle Orthodont. 27:98 April 1957.

Fifty Class II, Division I malocclusions, in the late mixed and adult dentition, treated with neckband, have been studied by means of cephalometric roentgenograms taken before and after treatment. Of these adults, 27 were males and 23 females. The patients were grouped according to sex and whether or not extractions were performed during the course of treatment. Additional correlations were made with the entire sample, relating age for starting and duration of treatment to the amount of change.

A posteriorly directed change in the position defined as point A related to nasion was elicited in each group with the greatest change occurring in the nonextraction group of males.

The forward growth of pogonion was disappointing except in the nonextraction group of males.

The maxillary first molar appeared to be held back as the face grew forward.

Nearly all faces exhibited downward growth in excess of forward growth.

Changes in both the occlusal plane and the mandibular plane generally were small.

There appeared to be a relationship between starting age and the amount of change at point A, with the most change occurring in younger individuals.

The duration of treatment showed a definite relationship to the degree of change, with those treated the longest achieving the greatest change at point A.

FAMILIAL OSSEOUS DYSPLASIA OF THE JAWS

Irwin A. Small and Malcolm C. Young. J. Oral Surg. 16:35 Jan. 1958.

Two instances of familial multiple lesions of the jaws in children, known as "cherubism," and "familial intraosseous fibrous swellings of the jaws" are reported with a summary of the clinical, roentgenographic and pathologic findings of these and 19 previously reported cases. The various theories of etiology are discussed and similar lesions are compared with these cases.

Clinically and roentgenographically the lesion may resemble giant cell tumor, fibrous dysplasia, odontogenic cyst, ameloblastoma and osteitis fibrosa cystica. Bilateral occurrence and familial incidence are suggestive of the lesion. A biopsy is imperative to establish diagnosis. The treatment consists of conservative surgical excision and curettage. Recurrence is possible after incomplete removal, but continued progressive growth or development of malignant neoplasm has not been reported.

Because of the multiple sites and familial occurrence, the early age of onset, the uniformly benign behavior, and certain distinguishing pathologic features, the term "familial osseous dysplasia" is proposed for this disease.

JOURNAL OF DENTAL RESEARCH
October 1957

STRUCTURE OF THE ROSTRAL TEETH AND THE ROSTRUM OF PRISTIS MICRODON

Eric W. Bradford, p. 663.

A study of the rostra and spines of museum specimens of *Pristis microdon,* by means of ground and decalcified sections, showed that these differed in structure from the classical concept. The basic structure of both rostra and spines was similar, being composed of innumerable polygonal systems running parallel to the long axis of the organ, and cemented in close apposition to each other. Each system seen in transverse section was composed of a more or less hyaline matrix surrounding a central canal from which arose small branches which arborized into the matrix. The matrix consisted of rods which commenced at the wall of the central canal and ran parallel to this. The rods were bounded for a portion of their periphery by a rod sheath, and were cemented together by an interrod tissue. No conclusions could be drawn as to the true nature of the tissue, nor as to its possible evolutionary relationships.

INVESTIGATIONS OF THE INFLUENCE OF VASCULARITY AND INNERVATION ON TOOTH RESORPTION AND ERUPTION

Barry G. Miller, p. 669.

Resorption of the dentitions as influenced by sectioning of the common carotid artery and the inferior alveolar nerve as well as resection of the cervical sympathetic chain were studied in a series of 36 rabbits and 36 rats.

In order to initiate an alteration of the blood supply to the mandible, two groups of 12 rabbits and two groups of 12 rats each were subjected, respectively, to unilateral ligation on rabbits and bilateral ligation on rats of the common carotid artery and resection of the cervical sympathetic chain unilaterally in rabbits and bilaterally in rats. A third procedure to eliminate afferent innervation was accomplished unilaterally on 12 additional rabbits and bilaterally on 12 additional rats by sectioning the inferior alveolar nerve.

On the basis of histologic and roentgenographic findings, the following conclusions are suggested: (1) there is a direct relationship between osteoclastic activity and the degree of vascularity in dental and supporting tissue, (2) resorption in deciduous teeth of rabbits is seemingly sufficiently advanced by the seventh day of life (time of operation) so that any alteration of osteoclastic activity (vascularity) has little or no effect on exfoliation of the teeth, (3) eruption rates of rat incisors do not appear to be sensitive to even fairly considerable alteration of blood flow to adjacent tissue, and (4) bilateral sectioning of the inferior alveolar nerve in rats is followed by an acceleration of mandibular incisor eruption.

INFLUENCE OF SYSTEMICALLY ADMINISTERED TRYPAN BLUE ON PRENATAL DEVELOPMENT OF RATS AND MICE

Seymour J. Kreshover, Holmes T. Knighton and James A. Hancock, Jr., p. 677.

Whereas previous studies have demonstrated the relationship of a variety of maternal disease processes to congenital malformations, little is known of the mechanism by which defects are produced. After demonstrating such abnormalities as hydrocephalus and spina bifida in litters of rats inoculated with trypan blue, previous investigators hypothesized that tissue breakdown in maternal diseases causes a release into the circulation of abnormal metabo-

lite particles which bind with various plasma proteins.

In order to evaluate this idea with particular reference to dental tissues, 124 rats and 217 mice received one, two, or three subcutaneous injections of 0.25 to 1.0 ml. of 1 per cent trypan blue from the prebreeding period to 20 days gestation. Twenty-five rats and 68 mice were similarly inoculated with distilled water and served as controls. Onset of pregnancy was denoted by either spermatozoa in vaginal smears or vaginal plug formation. Cesarean section was performed shortly before estimated day of delivery.

No fetuses were found in 28 per cent of the experimental rats and 63 per cent of the experimental mice. This compared with an 8 and 38.2 per cent failure of pregnancy in the respective control groups. Of the 108 dye inoculated rats that contained fetuses, 25 per cent showed abnormal young and 31 per cent showed fetal resorption. In 84 pregnant experimental mice, there were 28 per cent malformations and 70 per cent resorptions. The control rats had entirely normal litters and the control mice had 12 and 50 per cent incidences respectively of abnormal and resorbed young. No evidence of abnormal odontogenesis was found.

STUDIES OF THE COMPOSITION OF TEETH. VI. COMPOSITION OF SYRIAN HAMSTER ENAMEL AND DENTIN EXTRACTED WITH KOH-ETHYLENE GLYCOL

George W. Burnett and Joseph A. Zenewitz, p. 684.

A study was made of the nitrogen content, KOH-ethylene glycol extractable content, and the principal inorganic elements in extracted residues of Syrian hamster enamel and dentin for comparison with similar data obtained previously of enamel and dentin subjected to heating at 900° C. The protein content of the tissues, as established by nitrogen analysis, was usually less than the material removed by KOH-ethylene glycol extraction. Some quantities of calcium, phosphorus, and magnesium, particularly phosphorus, were removed during the extraction process, together with the organic components. Neither the protein nor extractable fraction of the tissues was usually as great as that portion of the tissues removed at 900° C. The KOH-ethylene glycol extracted tissue residues contained more calcium and less phosphorus than similar tissue residues heated to a constant weight at 900° C. The calcium: phosphorus ratios of the ethylene glycol extracted tissues were generally higher than those of heated tissues.

CLINICAL AND BACTERIOLOGIC STUDIES OF CARIES-IMMUNE HUMAN BEINGS

Paul R. Weisenstein and Gordon E. Green, p. 690.

Eighty-nine caries-immune human beings were observed clinically and bacteriologically during a three year period. These were divided into three clinical categories based on the clinical anatomic condition of the teeth. Bacteriologic examination showed that low or zero salivary lactobacilli counts were common in most of the immune individuals, but no striking bacteriologic differences were found among the three clinical groups. Five individuals who developed caries under observation were found to exhibit differences in salivary lactobacilli from those who did not develop dental caries.

THE RELATION OF STREPTOCOCCI, LACTOBACILLI, AND THE GENERAL ORAL AND FECAL FLORA TO THE PROGRESSION OF DENTAL CARIES IN THE HAMSTER

Morrison Rogosa, Erling Johansen and Murray Disraely, p. 695.

A technic for repeated bacteriologic samplings of hamster saliva and correlative dental examinations has been developed. No positive relationship was found between salivary streptococci and dental caries in either male or female hamsters. No correlation was observed between salivary lactobacilli and dental caries in females. In male hamsters, a positive relationship was noted between lactobacilli and dental caries, but only after extensive development of lesions. The final mean caries scores of males and females in this study were not significantly different.

The ecologic relations of the streptococci and lactobacilli were widely different in the mouth as compared to the feces. Microscopic examination of oral and fecal smears indicated that the streptococci and lactobacilli were a relatively small part of the total flora and that a great percentage of the organisms, such as fusiforms, bacteroides, large coccal organisms other than streptococci, have not been cultured.

EFFECT OF SEX HORMONES ON DENTAL CARIES IN DESALIVATED RATS

David Bixler, Joseph C. Muhler and William G. Shafer, p. 709.

Injection of either estradiol or testosterone into castrated animals restored the dental caries incidence to the control level. Similarly,

the injection of these hormones into castrated and salivariadenectomized rats restored the caries incidence to the same high level found in salivariadenectomized rats. These results indicate that the major salivary glands are probably not important intermediates in a sex hormone-dental caries relationship in the rat.

ENZYMES OF HUMAN SALIVA. II. PAROTID SALIVA TOTAL ESTERASES

Howard H. Chauncey, Fabian Lionetti and Vincent F. Lisanti, p. 713.

The enzymatic hydrolysis of beta-napthylacetate by human parotid saliva was investigated. Optimum activity was observed at pH 8.6. The Michaelis-Mentin constant was calculated to be 1.45×10^{-3} M. The energy of activation was 5,900 cal. per mole with maximum activity occurring at 60° C.

IS COLLAGENASE FOUND IN SALIVA FROM PERIODONTAL DISEASED MOUTHS?

Arnold A. Swanson, p. 717.

The failure to provide evidence that the enzyme collagenase could be found in saliva from periodontal conditions by employing specific tests suggests the following possibilities: (1) it is not present, or is present in concentrations so small as to exert minimal effect on healthy collagen, or (2) as a product of microorganisms it accumulates in recesses which protect it against ready contact with saliva and obstruct or prevent the effects of ordinary oral hygiene practices.

MICROHARDNESS STUDIES OF INTACT SURFACE ENAMEL

Robert C. Caldwell, M. L. Muntz, R. W. Gilmore and Ward Pigman, p. 732.

With the Knoop indenter, hardness measurements can be made on the intact enamel surfaces of extracted teeth in the outer 0.005 mm. The deviations of hardness values on the intact tooth surface usually are somewhat greater than for polished surfaces. A portion of the deviation seems to arise from the curvature of the surfaces.

The average hardness of the teeth studied was about 380 Knoop numbers (K.N.) similar to that for a hard stainless steel (370 K.N.). Extreme variations fell in the range 250 to 500 K.N. Variation, almost to these extremes, could be found on some single surfaces, and appeared to represent local variations, with no consistent pattern.

Variations among tooth types in the same and different mouths, between surfaces on the same tooth, between deciduous, erupted, and unerupted teeth, and between teeth from individuals of different ages were not pronounced. The observed variation seemed generally to fall in the range that could occur on a single surface.

AN ABRASION METHOD FOR DETERMINING THE WEAR RESISTANCE OF TEETH

F. Taketa; H. S. Perdue; W. F. O'Rourke; H. W. Sievert and P. H. Phillips, p. 739.

An abrasion apparatus for determining the wearing quality of the teeth of rats has been developed. The wear sustained by the sample on a silicon carbide belt under a given force, number of revolutions, and rate of travel of the belt, was measured. The surface area of the sample impinging on the belt was measured by taking planimeter tracings of projected wax impressions. By measuring wear as a function of surface area of the sample in contact with the belt, values of relative wear for different samples were readily obtained.

SPECTROPHOTOMETRY OF SALIVA

J. H. Geller and G. H. Rovelstad, p. 745.

Spectral analyses of 200 samples of saliva of 60 different subjects scanned from 230 millimicrons to 700 millimicrons wavelength on an automatic ratio recording spectrophotometer. They revealed absorption curves with peaks at specific wavelengths corresponding to: (1) amino acids (280 millimicrons), (2) proteins (278 millimicrons), (3) uric acid (285 millimicrons), (4) hemoglobin (415 millimicrons, 540 millimicrons, and 575 millimicrons), and (5) nucleoprotein (260 millimicrons).

The degree of absorption was proportional to the concentrations of these constituents.

IRON CONTENT OF TEETH IN HEMOSIDEROSIS

Benjamin H. Landing; M. E. Lahey, William K. Schubert and Joan Spinanger, p. 750.

Analyses for iron were performed on two carious teeth from a girl who had received many transfusions, totaling approximately 21,600 cc. of blood (11 Gm. of iron) over a seven-year period, and who had developed transfusional hemosiderosis. The teeth studied contained an average of 50.8 micrograms of iron per gram of tooth, whereas the average value of similarly treated carious teeth from control patients was 16.1 micrograms per gram. Whether the iron was deposited in the teeth before or after eruption is not known.

Since salivary glands commonly show hemosiderosis in iron-storage disease, the iron content of saliva in such patients may be elevated, and the teeth may absorb iron from the saliva.

DISCOLORATION OF TEETH BY METALLIC IONS

Sally Isaac and Finn Brudevold, p. 753.

The crown and root surfaces of intact teeth were treated with solutions of cupric sulfate, ferric nitrate, stannous chloride, silver nitrate, mercuric chloride and lead nitrate and subsequently exposed to a sulfide-containing medium. Concentrations of 100 and 1,000 ppm of cation were tested. The formation of a dark metallic sulfide in each instance indicated that all the metallic cations were taken up by the tooth structures. The degree of discoloration gauged by inspection was substantiated by quantitative readings taken with a photometer which measured directely in foot lamberts the amount of light reflected from a given surface. The degree of discoloration was affected by the pH of the solutions used and was generally more noticeable on the root surfaces than on the crowns. Areas which had been pre-etched showed a greater tendency toward discoloration.

EFFECT OF NITRIC ACID AND CHELATION DEMINERALIZATION ON VARIOUS STAINS OF HISTOCHEMICAL NATURE

Dorothy F. Mardfin and Verda Elizabeth James, p. 759.

For the effect of nitric acid and chelation demineralization on hematoxylin and eosin, Feulgen Schiff, thionin, and azure "B" stains, rat cerebellum was the tissue used because of its large cells and because the tissue could also be studied in an undemineralized state. Comparisons were made of the effect of fixation (frozen and dried and Formalin), of demineralizing treatment (ethylenediamine tetraacetic acid and nitric acid), and of embedding media (paraffin and celloidin). In both methods of fixation the staining reaction was similar but the intensity was greater with Feulgen Schiff, thionin, and azure "B," and more detailed in cellular morphology with Formalin fixation.

EDTA-treated material gave characteristic staining with hematoxylin and eosin, Feulgen Schiff, thionin, and azure "B," although the staining was less intense with thionin and azure "B" than in the untreated material.

Nitric acid-treated material stained with hematoxylin and eosin showed an over-all eosinophilia, whereas that stained with Feulgen Schiff, thionin, and azure "B" was colorless.

Both paraffin and celloidin gave comparable results when the chelated material was stained with hematoxylin and eosin, but paraffin was more satisfactory than celloidin when EDTA-treated material was stained with Feulgen Schiff, thionin, and azure "B."

ENAMEL CARBONATE IN CARIES

T. B. Coolidge and M. H. Jacobs, p. 765.

Analyses show that carbon dioxide is lost faster than calcium and phosphate from clinical "white spot" smooth surface caries and from artificial lesions resembling clinical lesions.

THE PRODUCTION OF ACIDS FROM GLUCOSE BY ORAL MICROORGANISMS: ACIDS OF THE KREBS CYCLE

Isaac Neuwirth and Paul J. Baerger, p. 769.

This is a continuation of previous studies on the question of acid production from glucose by oral microorganisms. In the present study, use was made of paper chromatography for the detection of acids of the Krebs cycle. Under the experimental conditions used, it was found that the following acids of the Krebs cycle are produced: malic, oxalacetic, alpha-ketoglutaric, succinic, fumaric, pyruvic, and lactic.

Except for lactic and citric acids, the concentration of these acids increases with time. The amounts of these acids produced under the experimental conditions bear no relation to the clinical caries picture of the subjects from whom the saliva samples were obtained.

REACTION OF TOOTH SURFACES WITH ONE PPM OF FLUORIDE AS SODIUM FLUORIDE

F. Brudevold; J. W. Hein; J. F. Bonner; R. B. Nevin; B. G. Bibby and H. C. Hodge, p. 771.

The uptake of radioactive fluoride from sodium fluoride solutions containing 1 ppm of fluoride varied in different teeth and different regions in the same tooth. Brushing with water caused a rapid loss of fluoride during the first three minutes and decreasing loss thereafter. Brushing with abrasives removed most of the fluoride after 30 seconds, demonstrating that there was only a slight fluoride penetration into the enamel. The rate of uptake was greatest during the first few minutes

of exposure and decreased with time. Pumiced, ground, or acid-etched surfaces showed greater uptake than intact surfaces. Slightly demineralized regions, that is, brown or white spots, showed greater uptake than sound enamel.

THE EFFECT OF TOPICALLY APPLIED POTASSIUM FLUOROSTANNITE ON THE DENTAL CARIES EXPERIENCE IN CHILDREN

Charles W. Gish, Joseph C. Muhler and Charles L. Howell, p. 780.

Ten months after the initial treatment of 442 children with a 4 per cent aqueous solution of potassium fluorostannite, there was a reduction of dental caries of 53.7 per cent and 39.2 as evaluated by the DMFT and DMFS indexes, respectively, when compared to a similar group of 452 children receiving four applications of distilled water. These differences were highly significant.

A NEW APPROACH TO THE TOPICAL APPLICATION OF FLUORIDES FOR THE REDUCTION OF DENTAL CARIES IN CHILDREN

Charles W. Gish, Charles L. Howell and Joseph C. Muhler, p. 784.

The application of an 8 per cent solution of stannous fluoride once to the teeth of 247 second grade children resulted in 21 to 26 per cent greater reduction in new caries lesions after eight months as compared with that achieved in 242 second grade children who were treated four times with a 2 per cent sodium fluoride solution.

EFFECT OF VANADIUM PENTOXIDE, FLUORIDES, AND TIN COMPOUNDS ON THE DENTAL CARIES EXPERIENCE IN RATS

Joseph C. Muhler, p. 787.

Stannous fluoride (alone and with sodium or potassium fluoride), stannous chloride (alone and with sodium fluoride), stannous gluconate (alone and with sodium fluoride), and potassium fluorostannite were administered to weanling rats in the drinking water for 140 days. Dental caries rates were significantly reduced by stannous fluoride, by potassium fluorostannite, and by stannous chloride and stannous gluconate to which sodium fluoride was added. The stannous salts alone (without fluoride) were essentially without effect. Stannous fluoride supplying fluoride at a level of 30 micrograms per milliliter was more effective than an equimolecular mixture of stannous fluoride with either sodium or potassium fluoride, which furnished fluoride at the same level; in the latter instances the tin level was, of course, reduced by 50 per cent.

The effectiveness of vanadium pentoxide, ammonium silicofluoride, sodium hexafluorostannite, sodium fluoride, stannic fluoride, and potassium fluoride were studied for their anticariogenic effectiveness in rats. None of the solutions significantly reduced the incidence of dental caries except stannic fluoride and sodium fluoride, and these were significant only at a low level of confidence. The vanadium pentoxide solutions were highly toxic as evidenced by the failure of the rats to gain weight normally as well as by the high mortality rate during the study.

GEOGRAPHICAL DISTRIBUTION OF DENTAL CARIES OF YOUNG SCHOOL CHILDREN IN THE NETHERLANDS (PERIOD 1950-1953)

J. B. Zwaardemaker and S. W. Tromp, p. 795.

During the years 1950, 1951, 1952, 1953, the percentage of school children (6 and 7 years of age) with perfect dentition (that is, less than two caries elements, using macroscopic identification methods only) was determined for the various school districts in the Netherlands. The geographical distribution map prepared on the basis of these data suggests considerable regional differences which cannot be explained by social factors only. Possible effect of soil differences is suggested.

Deaths

Agatston, Louis N., New York; New York College of Dentistry, 1906; died October 4; age 75.

Annis, Floyd M., Flint, Mich.; University of Michigan School of Dentistry, 1912; died October 17; age 70.

Barber, Fred J., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, 1919; died September 30; age 65.

Barnes, Frank F., Ripon, Wis.; Chicago College of Dental Surgery, 1893; died September 30; age 90.

Bates, Arthur A., Minerva, Ohio; Western Reserve University School of Dentistry, 1903; died October 6.

Batts, James W., Lexington, Ky.; University of Louisville School of Dentistry, 1929; died August 5; age 51.

Baumgarten, Maurice S., Union City, N. J.; University of Pennsylvania School of Dentistry, 1917; died September 21; age 62.

Beeks, Henry S., Richmond, Va.; Medical College of Virginia School of Dentistry, 1918; died June 24; age 68.

Birkholz, John C., Farmington, Minn.; University of Minnesota School of Dentistry, 1930; died October 19; age 52.

Black, Rhea Edwin, Chicago; Northwestern University Dental School, 1923; age 60.

Booth, Cecil O., Pittsburgh; Pittsburgh Dental College Western University of Pennsylvania, 1905; died October 13; age 74.

Bradburn, Albert G., Canandaigua, N. Y.; Philadelphia Dental College, 1900; died October 17; age 81.

Bright, Howard Christie, Manistee, Mich.; Marquette University Dental School, 1899; died June 21; age 80.

Brown, Clarence L., Coos Bay, Ore.; North Pacific College of Oregon School of Dentistry, 1918; died October 10; age 64.

Brown, George H., Beaumont, Texas; University of Texas School of Dentistry, 1915; died September 28; age 62.

Browning, John P., Seattle; Meharry Medical College School of Dentistry, 1927; died October 10; age 53.

Burbridge, Isaac R., McKeesport, Pa.; University of Pittsburgh School of Dentistry, 1921; died September 28; age 57.

Burgson, Clarence E., Sonora, Calif.; Northwestern University Dental School, 1904; died October 13; age 79.

Christman, Erving A., Joliet, Ill.; Western Dental College, 1919; died October 9; age 63.

Clark, Joseph S., Chicago; Northwestern University Dental School, 1913; died October 13; age 68.

Conlon, Norman A., Washington, D. C.; Georgetown University School of Dentistry, 1926; died September 22; age 57.

Crane, Joseph P., Philadelphia; University of Pennsylvania School of Dentistry, 1923; died October 7; age 55.

Daniel, John Wesley, Macon, Ga.; Atlanta College of Physicians and Surgeons, 1889; died March 3; age 94.

DeLaMater, Lyman S., Oneonta, N. Y.; University of Buffalo School of Dentistry, 1917; died August 8; age 64.

Dickerson, Cyrus G., Detroit; died September 22; age 79.

Donaldson, James C., East Palestine, Ohio; Ohio College of Dental Surgery, University of Cincinnati, 1901; died October 8; age 81.

East, Robert E., Hammond, Ind.; Ohio College of Dental Surgery, University of Cincinnati, 1919; died April 20.

Farley, LeRoy W., Trenton, N. J.; University of Pennsylvania School of Dentistry, 1912; died June 10; age 69.

Farnum, Stanford J., Cassopolis, Mich.; University of Michigan School of Dentistry, 1896; died May 17; age 82.

Fillinger, Chester W., West Allis, Wis.; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1925; died October 7; age 58.

Forest, Elvira, Bexar, Texas; Northwestern University Dental School, 1903; died March 25; age 82.

Fulton, Edwin L., Wichita, Kan.; Philadelphia Dental College, 1903; died October 13; age 83.

Gibbons, Junius, Phoenix, Ariz.; University of Southern California School of Dentistry, 1915; died July 20; age 70.

Gillham, Harry, Covington, Ky.; Ohio College of Dental Surgery, University of Cincinnati, 1895; died October 14; age 94.

Goen, Donald J., Manchester, Iowa; University of Iowa College of Dentistry, 1924; died August 10; age 56.

Gowan, Jesse Earl, Clanton, Ala.; Birmingham Dental College, 1906; died September 23; age 78.

Guerrier, Edwin E., Detroit; University of Michigan School of Dentistry, 1917; died October 12; age 73.

Guest, Henry Q., Elgin, Ill.; Northwestern University Dental School, 1904; died October 8; age 81.

Hamberg, Harvey U., New York; Columbia University School of Dental and Oral Surgery, 1939; died October 6; age 44.

Hardin, William R., Kansas City, Mo.; Ohio College of Dental Surgery, University of Cincinnati, 1900; died April 18; age 81.

Hart, Ernest J., Boston; Harvard Dental School, 1898; died October 4; age 81.

Hedburg, Robert L., Minneapolis; University of Minnesota School of Dentistry, 1919; died October 14; age 62.

Heise, Gustav H., Manitowoc, Wis.; Milwaukee Medical College Dental Department, 1903; died June 17; age 81.

Hines, Frank Benjamin, West Unity, Ohio; Northwestern University Dental School, 1901; died March 31; age 84.

Hoffman, J. Henry, Baltimore; Baltimore College of Dental Surgery, University of Maryland, 1891; died July 22; age 88.

Hucks, John H., Ehrhardt, S. C.; Southern Dental College, 1911; died October 15; age 77.

Hunter, Alexander S., Nashville, Tenn.; Meharry Medical College School of Dentistry, 1909; died August 25; age 73.

Hunter, Rufus Y., Crescent City, Fla.; Southern Dental College, 1914; died October 6; age 69.

Huschart, John H., Cincinnati; Ohio College of Dental Surgery, University of Cincinnati, 1900; died September 30; age 79.

Hutchinson, Harry W., Sutherlin, Ore.; Western Dental College, 1905; died August 14; age 75.

Hyams, Harry R., New York; New York College of Dentistry, 1913; died August 24; age 71.

Ide, Burt B., Baltimore; Baltimore College of Dental Surgery, 1902; died August 26; age 79.

Igo, Donald H., New Florence, Pa.; University of Pittsburgh School of Dentistry, 1926; died August 11; age 63.

Isenhower, Harry R., Bloomfield, Ind.; Northwestern University Dental School, 1898; died September 22; age 87.

Jagust, Samuel H., New York; University of Pennsylvania School of Dentistry, 1919; died April 26; age 64.

Jones, Elliot T., Jacksonville Beach, Fla.; Atlanta-Southern Dental College, 1922; died January 23, age 56.

Jones, Jobe William, Chattanooga, Tenn.; Vanderbilt University School of Dentistry, 1912; died August 31; age 77.

Kelley, Varney A., Port Blakely, Wash.; Tufts College Dental School, 1903; died August 11; age 74.

Kelly, William H., Milwaukee; Marquette University Dental School, 1914; died September 15; age 67.

Kindler, John A., Cleveland; Western Reserve University School of Dentistry, 1908; died August 14; age 77.

Klinke, Paul J., Youngstown, Ohio; Ohio State University College of Dentistry, 1927; died September 1; age 57.

Knudson, Raymond J., Des Moines, Iowa; Kansas City-Western Dental College, 1927; died October 8; age 57.

Kotecki, Anthony J., Toledo, Ohio; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1942; died October 12; age 42.

Larkin, Edgar D., Downingtown, Pa.; Philadelphia Dental College, 1892; died February 24; age 88.

Lavey, Meyer, Bronx, N. Y.; Baltimore College of Dental Surgery, University of Maryland, 1918; died September 16.

Leakey, Eustace P., Seattle; Northwestern University Dental School, 1904; died August 10; age 87.

Lehmer, Earle, Poughkeepsie, N. Y.; University of Pennsylvania School of Dentistry, 1930; died September 16; age 53.

Leicht, Eugene F., Rochester, N. Y.; University of Buffalo School of Dentistry, 1921; died September 24; age 58.

Levi, Robert H., Carlinville, Ill.; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1945; died July 29; age 35.

Lindburg, Harry L., Moline, Ill.; Chicago College of Dental Surgery, 1914; died July 1; age 71.

Littlefield, A. H., Parker, Ariz.; died August 23; age 89.

Lowery, Robert P., Bryn Mawr, Pa.; University of Pennsylvania School of Dentistry, 1919; died August 28; age 62.

Luckey, Franklin P., Paterson, N. J.; College of Dental and Oral Surgery, 1907; died September 23; age 73.

Ludlam, Earl G., Camden, N. J.; University of Pennsylvania School of Dentistry, 1924; died October 12; age 59.

Malone, William S., Birmingham, Ala.; Birmingham Dental College, 1910; died September 7; age 73.

Manning, Eugene E., Fremont, Calif.; Creighton University College of Dentistry, 1924; died August 17; age 57.

Marcilliat, Edward P., Louisville, Ky.; Louisville College of Dentistry, 1912; died October 9; age 68.

Marckres, Clair C., San Jose, Calif.; University of California College of Dentistry, 1897; died September 28; age 82.

Markey, Clare C., Fontana, Calif.; University of Michigan School of Dentistry, 1901; died October 15; age 78.

Markowitz, Louis J., Irvington, N. J.; Baltimore College of Dental Surgery, University of Maryland, 1933; died August 28; age 47.

Matthews, Ben B., New Orleans; Loyola University School of Dentistry, 1917; died August 18; age 61.

Mauer, Alvin M., Le Mars, Iowa; University of Iowa College of Dentistry, 1915; died October 3; age 66.

May, Richard R., Coffeyville, Kan.; Kansas City Dental College, 1915; died August 16; age 69.

Mayer, James E., Bluefield, W. Va.; Philadelphia Dental College, 1905; died September 30; age 72.

Mayo, Jesse E., Houston, Texas; State Dental College, 1918; died September 28; age 66.

Maze, Aurelius H., Winona, Minn.; University of Minnesota School of Dentistry, 1920; died August 4; age 61.

McCalla, William R., Laramie, Wyo.; Colorado College of Dentistry, 1918; died July 22; age 64.

McCarthy, Paul J., Philadelphia; University of Pennsylvania School of Dentistry, 1917; died August 7; age 66.

McCuskey, Hoy B., St. Marys, W. Va.; University of Maryland Dental Department, 1902; died September 7; age 76.

McGraw, William H., Carbondale, Pa.; University of Maryland Dental Department, 1892; died September 13; age 90.

McKenna, William L., Detroit; Northwestern University Dental School, 1913; died May 8; age 81.

McMahon, Harold C., South Brewer, Maine; University of Pennsylvania School of Dentistry, 1908; died September 18; age 71.

McWhorter, Edward S., La Jolla, Calif.; University of Iowa College of Dentistry, 1892; died August 4; age 87.

Mead, Roy E., Three Oaks, Mich.; Northwestern University Dental School, 1908; died October 4; age 74.

Mehaffey, Lloyd W., Washington, Pa.; Baltimore College of Dental Surgery, University of Maryland, 1919; died July 13; age 66.

Miller, Charles W., Minneapolis; University of Minnesota School of Dentistry, 1905; died September 23; age 76.

Monch, Theodore A., St. Louis; St. Louis University School of Dentistry, 1912; died October 13; age 68.

Moore, Thomas J., Rochester, Minn.; University of Minnesota School of Dentistry, 1908; died September 20; age 75.

Morrill, Everett E., Boston; Tufts College Dental School, 1918; died July 28; age 58.

Morrison, Herbert J., Oberlin, Kan.; Western Dental College, 1902; died September 4; age 80.

Moyer, Arnold R., Niagara Falls, N. Y.; University of Buffalo School of Dentistry, 1906; died July 31; age 73.

Murdock, Earl E., Gresham, Wis.; American College of Dental Surgery, 1891; died July 14; age 91.

Murphy, John D., Detroit; University of Michigan School of Dentistry, 1917; died September 15; age 68.

Murphy, William G., Chicago; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1928; died September 20; age 52.

Muth, Carl H., New Wilmington, Pa.; University of Pittsburgh School of Dentistry, 1919; died August 26; age 58.

Myers, Leslie G., Aurora, Neb.; Omaha Dental College, 1899; died August 6; age 85.

Naramore, Malta L., Fairfield, Ala.; Vanderbilt University School of Dentistry, 1918; died September 19; age 67.

Neely, Bassett W., Franklin, Ky.; University of Louisville School of Dentistry, 1936; died July 3; age 45.

Norris, Norman S., Culver, Ind.; Indiana Dental College, 1904; died September 2; age 77.

Norton, Carl H., Tampa, Fla.; Howard University College of Dentistry, 1917; died August 13; age 67.

Novario, Roxy M., Cleveland; Western Reserve University School of Dentistry, 1923; died September 25; age 60.

Numbers, Dwight M., Paola, Kan.; Western Dental College, 1913; died September 26; age 77.

Oattis, Nathaniel G., Columbus, Ga.; Atlanta Dental College, 1903; died September 10; age 81.

O'Connell, Frank A., O'Neill, Neb.; Creighton University College of Dentistry, 1915; died August 21; age 66.

O'Donnell, Roger J., Dorchester, Mass.; Tufts College Dental School, 1913; died August 4; age 67.

O'Quinn, Abraham E., Tifton, Ga.; Atlanta Dental College, 1910; died January 16; age 73.

Olson, Romans V., Eau Claire, Wis.; University of Minnesota School of Dentistry, 1926; died September 5; age 54.

Ortman, Max J., New York; New York College of Dentistry, 1903; died August 26; age 76.

Ott, Harry H., Gresham, Ore.; Western Dental College, 1906; died August 22; age 79.

Parker, T. William, Seattle; North Pacific College of Oregon, School of Dentistry, 1918; died October 9; age 70.

Patterson, George F., Peebles, Ohio; died September 15; age 91.

Pavlik, John J., Hazleton, Pa.; Temple University School of Dentistry, 1918; died August 27; age 64.

Pealer, Woodin W., Hazleton, Pa.; Philadelphia Dental College, 1901; died July 9; age 88.

Peladeau, Rosario, Fall River, Mass.; Tufts College Dental School, 1923; died July 15; age 59.

Pentz, James B., St. George, N. Y.; New York College of Dentistry, 1909; died August 13; age 76.

Peters, Fred C., Bay City, Mich.; University of Michigan School of Dentistry, 1916; died October 13; age 71.

Phelps, David R., Lynchburg, Va.; Atlanta Dental College, 1907; died October 7; age 77.

Phetteplace, Glenn C., Portland, Ore.; North Pacific College of Oregon School of Dentistry, 1922; died August 10; age 59.

Pickens, George D., Arcade, N. Y.; University of Buffalo School of Dentistry, 1908; died August 31; age 74.

Pickens, Robert O., Dallas; Western Dental College, 1901; died August 26; age 80.

Pitzer, Charles H., Fairbury, Neb.; University of Nebraska College of Dentistry, 1919; died October; age 65.

Ploss, Earl O., Snyder, N. Y.; University of Buffalo School of Dentistry, 1914; died July 16; age 69.

Plummer, Leo Benjamin, Detroit; University of Michigan School of Dentistry, 1900; died March 7; age 89.

Poole, Henry H., New Holland, Pa.; Temple University School of Dentistry, 1930; died October 10; age 49.

Pope, Lawrence C., Alpine, Texas; Texas Dental College, 1911; died August 7; age 69.

Posey, Thomas H., Lawrenceburg, Ky.; Louisville College of Dentistry, 1898; died August 17; age 80.

Price, William R., Little Rock, Ark.; North Pacific College of Oregon, School of Dentistry, 1931; died June 7; age 56.

Proctor, Louis C., Afton, Wyo.; Chicago College of Dental Surgery, 1901; died September 19; age 85.

Prybol, John B., Newark, N. J.; Temple University School of Dentistry, 1931; died August 18; age 62.

Ramsay, Clarence J., Torrence, Conn.; Philadelphia Dental College, 1902; died September 23; age 78.

Regan, Frank A., Milton, Mass.; died August 1; age 75.

Rice, John Henry, Itasca, Texas; Birmingham Dental College, 1894; died July 26; age 85.

Ringler, Charles W., Port Huron, Mich.; University of Michigan School of Dentistry, 1906; died August; age 78.

Robinson, Rowe H., Wolcott, Ind.; Northwestern University Dental School, 1900; died July 14; age 80.

Rogers, William C., Palmetto, Ga.; Atlanta-Southern Dental College, 1927; died October 15; age 60.

Rosenberg, Bernard, New York; New York University College of Dentistry, 1906; died July 24; age 76.

Roth, Yanno J., Chicago; Chicago College of Dental Surgery, 1900; died August 14; age 78.

Rountree, Frank L., Cedartown, Ga.; Southern Dental College, 1903; died July 12; age 76.

Rubenstein, Milton, Brookline, Mass.; Tufts College Dental School, 1923; died July 16; age 58.

Schlichter, William R., Yonkers, N. Y.; Columbia University School of Dental and Oral Surgery, 1925; died October 17; age 59.

Schomer, Henry, Jersey City, N. J.; University of Pennsylvania School of Dentistry, 1924; died October 5; age 55.

Schmidler, Alfred M., Wauwatosa, Wis.; Marquette University Dental School, 1910; died August 5; age 70.

Schultz, Julius F., Lincoln Park, Mich.; University of Detroit School of Dentistry, 1935; died October 3.

Scott, Harold O., Glendale, Calif.; Chicago College of Dental Surgery, 1902; died September 25; age 77.

Sewart, Albert Frank, Herington, Kan.; Kansas City Dental College, 1909; died September 26; age 70.

Shaughnessy, Lawrence J., Oglesby, Ill.; Chicago College of Dental Surgery, 1917; died October 3; age 65.

Shelledy, James E., Scranton, Iowa; University of Iowa College of Dentistry, 1909; died July 17; age 76.

Shawver, Charles M., Abingdon, Ill.; Indiana Dental College, 1902; died August 16; age 78.

Shulman, Sidney, Jamaica, N. Y.; University of Pennsylvania School of Dentistry, 1928; died September 25; age 51.

Simonton, George W., Oakland, Calif.; University of California College of Dentistry, 1916; died August 17; age 69.

Skalmer, Morris, New York; New York College of Dentistry, 1895; died October 22; age 82.

Smead, Samuel R., Indianapolis; Indiana Dental College, 1901; died September 25; age 85.

Smith, Abraham, Philadelphia; Temple University School of Dentistry, 1943; died August 21; age 46.

Smith, Chauncey G., Detroit; University of Michigan School of Dentistry, 1901; died September 8; age 80.

Smith, Horace A., Los Angeles; died August 27; age 77.

Smith, Robert C., Shawnee-on-Delaware, Pa.; University of Pennsylvania School of Dentistry, 1903; died August 15; age 78.

Snively, Norman R., Altoona, Pa.; University of Pennsylvania School of Dentistry, 1909; died September 25; age 68.

Spann, Sam T., Reno, Nev.; University of Southern California, School of Dentistry, 1916; died August 23; age 72.

Stabbert, Orlando C., Faribault, Minn.; University of Minnesota School of Dentistry, 1933; died September 11; age 48.

Starr, George F., Haddonfield, N. J.; University of Pennsylvania School of Dentistry, 1914; died August 28; age 67.

Stevens, Herbert F., Aberdeen, S. D.; University of Illinois College of Dentistry, 1914; died July 28; age 72.

Streett, H. Hayward, Baltimore, Md.; University of Maryland Dental Department, 1899; died July 27; age 80.

Strickland, Wadsworth O., Glennville, Ga.; Atlanta Dental College, 1910; died June 13; age 75.

Stubbs, Claude G., Chillicothe, Mo.; Lincoln Dental College of Cotner University, 1903; died August 11; age 82.

Stumpf, John F., Gretna, La.; Loyola University School of Dentistry, 1936; died July 15; age 44.

Sullivan, John E., Covington, Ky.; Cincinnati College of Dental Surgery, 1911; died July 23; age 66.

Sweet, Gilbert H., Oakland, Calif.; University of California College of Dentistry, 1924; died August 16; age 66.

Tankard, James A., Kansas City, Mo.; Western Dental College, 1919; died July 28; age 61.

Tulkin, Irvin, New York; Columbia University School of Dental and Oral Surgery, 1924; died April 28; age 54.

Van Surdam, Carl S., Winthrop Harbor, Ill.; Chicago College of Dental Surgery, 1920; died September 1; age 63.

Waelde, Frank F., Meadville, Pa.; University of Pittsburgh School of Dentistry, 1910; died August 2; age 72.

Waggoner, Hal A., Hamlin, W. Va.; University of Louisville School of Dentistry, 1927; died September 16; age 53.

Wagner, Charles R., Warsaw, Ind.; Indiana Dental College, 1914; died July 16; age 67.

Waldron, Ralph, South Orange, N. J.; New York College of Dentistry, 1906; died July 24; age 80.

Watson, Sam R., Henderson, N. C.; Baltimore College of Dental Surgery, University of Maryland, 1908; died August 17.

Wechsler, Morris, Marion, Va.; Medical College of Virginia School of Dentistry, 1930; died July 20; age 52.

Weissmann, Eugene, Brooklyn; New York College of Dentistry, 1909; died August 21; age 76.

Wells, Benjamin S., Baltimore; Baltimore College of Dental Surgery, University of Maryland, 1914; died August 19; age 65.

Werner, Arthur L., Appleton, Wis.; Marquette University Dental School, 1925; died July 12; age 54.

Wessel, Edward J., Mt. Holly, N. J.; Temple University School of Dentistry, 1927; died July 22; age 51.

White, Harry F., Blossvale, N. Y.; University of Pennsylvania School of Dentistry, 1899; died August 16; age 83.

Williams, Rolla G., Illmo, Mo.; Washington University School of Dentistry, 1905; died August 11; age 75.

Wilson, Charles R., Huntingdon, Pa.; University of Pennsylvania School of Dentistry, Philadelphia, 1910; died July 10.

Wilson, Joseph E., New York; University of Pennsylvania School of Dentistry, Philadelphia, 1912; died June 18; aged 68.

Witmer, E. Arthur, Adel, Iowa; Drake University College of Dentistry, Des Moines, Iowa, 1903; aged 82.

Wylde, David Z., Oblong, Ill.; Keokuk Dental College, Keokuk, Iowa, 1903; died June 1; aged 73.

Yerger, Howard C., Ridgewood, N. J.; Baltimore College of Dental Surgery, University of Maryland, 1947; died August 21; age 39.

York, Russell M., Cleveland; Western Reserve University School of Dentistry, 1925; died September 20; age 54.

Young, Alfred C., Pittsburgh; University of Pittsburgh School of Dentistry, 1915; died October 16; age 68.

Young, James W., Cedartown, Ga.; Atlanta Dental College, 1917; died September 2; age 61.

Ziolkowski, Henry I., Chicago; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1934; died September 28; age 48.

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All expressions of opinion and statements of supposed fact are published on the authority of the writer over whose signature they appear and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association. Articles are accepted with the understanding that they have not been published previously and that they are submitted solely to The Journal. The Journal of the American Dental Association is indexed in the Index to Dental Literature, in the Current List of Medical Literature and, in part, in the Quarterly Cumulative Index Medicus, Biological Abstracts and Chemical Abstracts.

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Announcements

MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

Ninety-Ninth Annual Session	Nov. 10-13, 1958	Dallas, Texas
One-Hundredth Annual Session	Sept. 14-18, 1959	New York
One-Hundred and First Annual Session	Oct. 17-20, 1960	Los Angeles
One-Hundred and Second Annual Session	Oct. 16-19, 1961	Philadelphia

MEETINGS OF CONSTITUENT SOCIETIES

State	Date	Place	Secretary	Address
Alabama	Apr. 24-26	Montgomery	C. R. Crook	Professional Center, Montgomery
Alaska	June 3-6	Palmer	C. L. Polley	Box 1896, Juneau
Arizona	Apr. 16-19	Tucson	W. G. Burke	15 E. Monroe St., Phoenix
Arkansas	Apr. 13-16	Little Rock	D. M. Hamm	Box 89, Clarksville
California	Apr. 20-23	San Francisco	W. J. Healy	450 Sutter St., San Francisco
S. California	Apr. 14-16	Los Angeles	S. M. Silverman	903 Crenshaw Blvd. Los Angeles 19
Colorado	Oct. 5-8	Colorado Springs	G. H. Jackson	724 Republic Bldg., Denver
Connecticut	May 14, 15	Hartford	E. S. Arnold	37 Linnard Rd., W. Hartford
Delaware			A. G. Schiek	3716 Philadelphia Pike, Claymont
District of Columbia	Mar. 9-12	Washington	J. F. Keaveny	1029 Vermont Ave., N.W., Washington
Florida	May 18-21	Miami Beach	G. J. Perdigon	17 Davis Blvd., Tampa
Georgia	Oct. 12-15	Atlanta	F. M. Butler, Jr.	Bankers Insurance Bldg., Macon
Hawaii	June 15-19	Honolulu	J. H. Dawe	810 N. Vineyard St., Honolulu
Idaho	June 16-18	McCall	G. L. Williamson	1003½ Main St., Boise
Illinois	May 11-14	Springfield	P. W. Clopper	632 Jefferson Bldg., Peoria
Indiana	May 19-21	Indianapolis	W. R. Shoemaker	Citizens Bank Bldg., Anderson
Iowa	May 5-7	Des Moines	H. I. Wilson	Insurance Exchange Bldg., Des Moines
Kansas	May 5-8	Kansas City Mo.	F. A. Richmond	Brotherhood Bldg., Kansas City 1
Kentucky	Mar. 23-26	Louisville	A. B. Coxwell, Jr.	2208 Dundee Rd., Louisville 5
Louisiana	Apr. 9-12	Monroe	J. S. Bernhard	2515 Line Ave., Shreveport
Maine	June 19-21	Rockland	S. M. Gower	Box 27, Skowhegan
Maryland	May 4-7	Baltimore	C. L. Inman, Jr.	Medical Arts Bldg., Baltimore
Massachusetts	May 4-7	Boston	H. E. Tingley	12 Bay State Rd., Boston 15
Michigan	Apr. 28-30	Detroit	F. Wertheimer	Michigan Dept. of Health, Lansing
Minnesota	Apr. 14-16	St. Paul	C. V. E. Cassel	2236 Marshall Ave., St. Paul 4
Mississippi	June 9-11	Biloxi	B. A. Cohen	300-E E. Woodrow Wilson Dr., Jackson 27
Missouri	May 4-8	Kansas City	E. D. Suggett	Merchants Bank Bldg., Jefferson City
Montana	May 1-3	Butte	R. C. Ritter	28 N. Black St., Bozeman
Nebraska	Apr. 28-30	Omaha	F. A. Pierson	Federal Securities Bldg., Lincoln
Nevada	June 12-15	Lake Tahoe	O. M. Seifert	755 Ryland Ave., Reno
New Hampshire	June 22-24	Whitefield	F. E. Williams	814 Elm St., Manchester
New Jersey	May 18-21	Atlantic City	J. G. Carr	407 Cooper St., Camden
New Mexico	May 25-28	Las Cruces	J. S. Ellar	7 Medical Arts Sq., N.E., Albuquerque
New York	May 12-14	Buffalo	C. A. Wilkie	1 Hanson Pl., Brooklyn 17
North Carolina	May 4-7	Pinehurst	L. H. Butler	Jefferson Bldg., Greensboro

State	Date	Place	Secretary	Address
North Dakota	May 4-7	Bismarck	J. H. Pfister	419½ Dakota Ave., Wahpeton
Ohio	Sept. 28-Oct. 1	Cincinnati	E. G. Jones	185 E. State St., Columbus
Oklahoma	Apr. 20-23	Oklahoma City	L. D. Wright	Osler Bldg., Oklahoma City
Oregon	Mar. 3-5	Portland	T. D. Holder	Selling Bldg., Portland
Panama Canal Zone	Apr.	Ancon	W. R. Bond, Jr.	U.S.A., Ft. Kobbe Dental Clinic, Ft. Kobbe
Pennsylvania	May 21-23	Harrisburg	M. D. Zimmerman	217 State St., Harrisburg
Puerto Rico			R. Borges	Box 843, Arecibo
Rhode Island	Jan. 21, 22, 1959	Providence	H. A. McGuirl	Union Trust Bldg., Providence
South Carolina	May 25-27	Myrtle Beach	J. E. Wallace	1506 Gregg St., Columbia
South Dakota	May 11-13	Mitchell	R. E. Decker	Box 308, Parker
Tennessee	May 12-15	Chattanooga	K. P. Ezell	116 N. Academy, Murfreesboro
Texas	May 3-6, 1959	San Antonio		3707 Gaston Ave., Dallas 10
Utah	May 22-24	Salt Lake City	R. C. Dalgleish	State Capitol Bldg., Salt Lake City
Vermont	June 27-29	Manchester	E. H. Van Santvoord	22 Washington St., Rutland
Virginia	May 4-7	Richmond	W. T. McAfee	Colonial National Bank Bldg., Roanoke
Washington	Mar. 24-26	Seattle	H. B. Henderson	211 Medical Dental Bldg., Seattle 1
West Virginia	July 20-23	White Sulphur Springs	G. N. Casto, Jr.	710½ Lee St., Charleston
Wisconsin	Apr. 21-23	Milwaukee	H. O. Hoppe	1331 W. Vliet St., Milwaukee
Wyoming	June 19-21	Casper	T. J. Drew	State Office Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	Date	Place	Secretary	Address
Alabama	June 22-27* June 23, 24	Birmingham	W. L. McCarty	Professional Center, Montgomery
Alaska			R. H. Williams	Box 2122, Juneau
Arizona	June 23-30	Florence	W. G. Biddulph	1502 W. Osborn Rd., Phoenix
Arkansas	June 16-20	Little Rock	W. T. Jones	107 E. Shelton, Monticello
California	Feb. 3 June 16 June 23	San Francisco San Francisco Los Angeles	D. R. Grant	807 Polk St., San Francisco
Colorado	June 22-28	Denver	R. F. Gilmore	Republic Bldg., Denver 2
Connecticut	June 23-25* June 27, 28* June 26† June 27, 28†	Boston Bridgeport Bridgeport Bridgeport	C. G. Brooks	302 State St., New London
Delaware			P. K. Musselman	143 W. Main St., Newark
District of Columbia			W. T. Birthright	1835 Eye St., N.W., Washington
Florida	July 6-17* July 7, 8†	Jacksonville	R. P. Taylor, Jr.	P. O. Box 2913, Jacksonville 3
Georgia	June 9-11	Atlanta	W. G. Brown	Blackshear
Hawaii			J. Y. Ing	James Campbell Bldg., Honolulu
Idaho	June 23-25	Boise	A. G. DeWinter	Sun Bldg., Boise
Illinois	June 24-27	Chicago	W. A. McKee	Wood Bldg., Benton
Indiana	June 10-13*†	Indianapolis	C. A. Frech	Gary National Bank Bldg., Gary
Iowa	June 2-6*†	Iowa City	P. A. Hahn	Farmers & Merchants Bank Bldg., Burlington
Kansas			G. L. Teall	Box 71, Hiawatha
Kentucky	June 9-12*†	Louisville	J. J. Kelly	102 W. Madison St., Franklin
Louisiana	June 2-7	New Orleans	R. C. Steib	Maison Blanche Bldg., New Orleans
Maine			A. S. Appleby	Box 260, Skowhegan
Maryland	June 9-11‡		W. D. Burton	829 Park Ave., Baltimore 1
Massachusetts	June 9-13*‡ June 12, 13†‡		A. M. Bommer	33 State House, Boston
Michigan	June 8-14		J. L. Champagne	3714 W. McNichols Rd., Detroit 21
Minnesota			E. A. Nelson	2236 Marshall Ave., St. Paul 4

State	Date	Place	Secretary	Address
Mississippi	June 17-19*†	Jackson	A. H. Richter, Jr.	Aven Bldg., Greenwood
Missouri	June 9-11, 16, 17*	Kansas City	R. R. Rhoades	Central Trust Bldg., Jefferson City
	June 12-14, 16-17*	St. Louis		
Montana			R. O. Betzner	303 Power Block, Helena
Nebraska	June 5-11	Lincoln	H. E. Weber	Stuart Bldg., Lincoln
Nevada	June 16	Reno	R. Whitehead	40 W. First St., Reno
New Hampshire	June 19, 20* June 19†	Boston	S. G. Markos	8 Renaud Ave., Dover
New Jersey	June 5, 6*	New York	C. J. Schweikhardt	150 E. State St., Trenton 8
	June 9, 10*	Philadelphia		
	June 13, 14*	Trenton		
	June 18†	Teaneck		
	June 23, 24*	Philadelphia		
New Mexico	June 23-26	Santa Fe	J. J. Clarke, Sr.	Artesia
New York	June 19, 24, 25†‡		D. W. Beier	23 S. Pearl St., Albany 7
	June 19, 20, 24-27*‡			
	Dec. 2-5, 8, 9*‡			
North Carolina	June 23*†	Chapel Hill	J. H. Guion	Doctors Bldg., Charlotte 7
North Dakota	July 7-11	Fargo	G. F. Wirtz	Clinic Bldg., Mandan
Ohio	June 12-14*	Cleveland	D. E. Bowers	322 E. State St., Columbus 15
	June 18-20*	Columbus		
	June 21-25*	Columbus		
	June 21†	Columbus		
Oklahoma	June 23-25*	Oklahoma City	W. H. Stephens	Plaza Court Bldg., Oklahoma City
	June 23, 25†			
Oregon	June 9-12	Portland	F. L. Utter	Pioneer Trust Bldg., Salem
Pennsylvania	May 26-28*†	Pittsburgh	R. E. V. Miller, Sr.	Dept. of Public Instruction, Box 911, Harrisburg
	June 5-7*†	Philadelphia		
	June 16, 17*†	Philadelphia and Pittsburgh		
	June 18-20*†	Philadelphia		
Puerto Rico			J. Mercado C.	Comercio St. #452, San Juan
Rhode Island			F. M. Hackett	267 Academy Ave., Providence
South Carolina	June 19-21‡		W. J. Brockington	1508 Washington St., Columbia 1
South Dakota	June 22-25*†	Sioux Falls	H. T. Aker	Canton
Tennessee			C. R. Aita	Bennie-Dillon Bldg., Nashville
Texas			R. T. Weber	Capital National Bank Bldg., Austin 16
Utah	June 23-28‡		M. T. Rigby	47 E. Center St., Midvale
Vermont	June 23-25*†	Burlington	P. M. Fitch	Newport
Virginia			J. M. Hughes	Medical Arts Bldg., Richmond
Washington			F. S. Rotchford	1108 S. Washington St., Olympia
West Virginia	June 23-25	West Liberty	C. C. Cottrill	Box 111, Glen Rogers
Wisconsin	June 9-13*†	Milwaukee	S. F. Donovan	Tomah
Wyoming	June 23-25*†‡		E. E. Edwards	Bank of Commerce Bldg., Sheridan

Most states require applications to be in 30 days prior to examination date.
*Dental examination. †Dental hygiene examination. ‡Write to secretary of dental examining board for information on locations of examinations.

MEETINGS OF OTHER ORGANIZATIONS

Name	Date	Place	Secy. or Chm.	Address
Academy of Denture Prosthetics	May 5-9	Detroit	W. L. Warburton Secy.	Medical Arts Bldg., Salt Lake City 11
American Academy of Dental Medicine	May 29-31	Montreal, Canada	G. J. Witkin Secy.	45 S. Broadway, Yonkers 2, N. Y.
American Academy of Oral Pathology	Mar. 30, 31	Washington, D.C.	J. L. Bernier Secy.	Armed Forces Institute of Pathology, Washington 25, D.C.
American Association for Cleft Palate Rehabilitation	Apr. 24-26	San Francisco	D. C. Spriestersbach Secy.	Dept. of Otolaryngology University Hospitals, Iowa City
American Association of Dental Schools	Mar. 23-26	Detroit	M. W. McCrea Secy.	University of Minnesota School of Dentistry, Minneapolis 14
American Association of Industrial Dentists	Apr. 21-23	Atlantic City, N. J.	E. R. Aston Secy.	Pennsylvania Dept. of Health, P. O. Box 90, Harrisburg, Pa.
American Association of Orthodontists	Apr. 27-May 1	New York	E. E. Shepard Secy.	8230 Forsyth Blvd., St. Louis 24
American Board of Dental Public Health	Nov. 6, 7	Dallas, Texas	C. V. Tossy Secy.	Michigan Dept. of Health, Lansing, Mich.

Name	Date	Place	Secy. or Chm.	Address
American Board of Oral Surgery	Apr. 5-8	Chicago	L. M. FitzGerald Secy.	Roshek Bldg., Dubuque, Iowa
American Board of Pedodontics	July 29-31	Indianapolis	R. L. Ireland Secy.	College of Dentistry, University of Nebraska, Lincoln 8, Neb.
American Dental Society of Europe	July 2-5	Knokke, Belgium	J. P. Molony Secy.	110 Harley St., London W.1, England
American Society of Oral Surgeons	July 30-Aug. 2	Chicago	A. B. Coxwell Exec. Secy.	2208 Dundee Rd., Louisville 5, Ky.
American Society of Psychosomatic Dentistry	Mar. 9	Washington, D. C.	E. G. Lerner Secy.	2177 Seneca St., Buffalo 10, N. Y.
Ark-La-Tex Dental Congress	Aug. 18	Shreveport, La.	J. Wyrick Secy.	Texarkana National Bank, Texarkana, Texas
Arpa Internationale, Twenty-fifth Congress	July 7-12	Paris, France	A. J. Held Pres.	Institute Universitaire de Medecine Dentaire, 24 rue Micheli-du-Crest, Geneva, Switzerland
Asian Dental Congress (Second) and Asian-Pacific Dental Conference	Mar. 24-30	Manila, Philippines	B. B. Erana Pres. Elect	P. O. Box 373, Manila, Philippines
Berkshire Conference (Ninth)	June 15-19	Lenox, Mass.	I. Glickman Dir.	Tufts University, School of Dental Medicine 136 Harrison Ave., Boston 11
British Columbia Dental Association	May 1-3	Vancouver	I. U. MacIntosh Secy.	624 Sixth St., New Westminster, B.C., Canada
British Dental Association	July 7-12	Dundee, Scotland	H. P. Buchanan Secy.	13 Hill St., Berkeley Square, London W.1, England
Chicago Dental Society		Chicago	K. S. Richardson Exec. Secy.	30 N. Michigan Ave., Chicago
Cincinnati Dental Society	Mar. 23-25	Cincinnati	H. F. Lee Chm.	3180 Harrison Ave., Cincinnati 11
Cleveland Dental Society	Apr. 28-30	Cleveland	G. A. Blizil Exec. Secy.	1220 Huron Rd., Cleveland 15
Council on Dental Education, Dental Aptitude Tests	Apr. 25, 26		S. Peterson Secy.	222 E. Superior St., Chicago 11
Endodontics, Second International Conference	June 22-28	Philadelphia	M. Kolb Secy.	4001 Spruce St., Philadelphia 4
European Organization for Research on Fluorine and Dental Caries Prevention, Fifth Congress	May 30-June 1	Brussels, Belgium	A. Syrriat Secy. Gen.	Ecole Dentaire Royale, Malmo, Sweden
European Orthodontic Society	July 4-8	Copenhagen, Denmark	A. Bjork	Royal Dental College, 4, Universitetsparken, Copenhagen, Denmark
Federation Dentaire Internationale, 46th Annual Meeting	Aug. 27-Sept. 3	Brussels, Belgium	G. H. Leatherman Secy.	35 Devonshire Pl., London W.1, England
German Cooperative Society for Research and Prevention of Dental Focal Infection	Apr. 9, 10	Weisbaden, Germany	K. Thielemann	Rubenstrasse 28, Frankfurt/Main, Germany
German Society for Prosthetic Dentistry	Mar. 27-29	Bad Pyrmont, Germany	J. Jantzen	Lazarettstr. 7, Essen, Germany
Greater Philadelphia Annual Meeting	Mar. 25-28	Philadelphia	M. Kohn Exec. Secy.	Sheraton Hotel, 17th St. and Pennsylvania Blvd., Philadelphia 3
International Association for Dental Research	Mar. 20-23	Detroit	D. Y. Burrill Secy.	311 E. Chicago Ave., Chicago 11
National Board of Dental Examiners	Mar. 31-Apr. 1		G. J. Casey Secy.	222 E. Superior St., Chicago 11
National Dental Association, Inc.	Aug. 3-7	Pittsburgh	E. N. Jackson Secy.	P. O. Box 197 Charlottesville, Va.
Northeastern Society of Orthodontists	Apr. 29	New York	D. Mossberg Secy.	36 Central Park S., New York
Northern Brazil, First Congress	July 7-12	Macapa	J. M. Lima Gen. Secy.	Central Committee on Organization, First Congresso Nortista de Odontologia, Macapa, Amapa Brazil

Name	Date	Place	Secy. or Chm.	Address
Northwest Academy of Dental Medicine	Apr. 22-26	Victoria, B.C., Canada	G. Underwood Secy.	Selling Bldg., Portland, Ore.
Pan-American Dental Congress	Nov. 18-22	Mexico City, Mexico	Secretary	Asociacion Dental Mexicana, Sinaloa 9, Mexico 7, D.F., Mexico
Society Suisse d'Odontologie, Annual Congress	May 8-11	Geneva, Switzerland	Secretary, S.S.O.	Spitalgasse 37, Bern, Switzerland
Southeastern Academy of Prosthodontics	Mar. 15, 16	Atlanta, Ga.	H. C. Parker Secy.	Liberty Life Bldg., Charlotte 2, N.C.
Southeastern Society of Oral Surgeons	May 2, 3	Daytona Beach, Fla.	P. B. Whittington, Jr. Secy.	Medical Arts Bldg., Greensboro, N.C.
Southern Academy of Oral Surgery	Mar. 14-16	Atlanta, Ga.	R. F. Sullivan Secy.	118 Jones St., E., Savannah, Ga.
Southern Academy of Periodontology	Mar. 30-Apr. 1	New Orleans	J. R. Owings Secy.	7 Medical Court, Greenville, S.C.
Southwest Society of Periodontists	May 3, 4	Waco, Texas	J. H. Swindle, Jr. Secy.	P. O. Box 3096, Westview Station, Waco, Texas
Thomas P. Hinman Dental Clinic	Mar. 16-19	Atlanta, Ga.	H. Wallace Secy.	1415 The By Way, N.E., Atlanta, Ga.
Western Society of Periodontology	Mar. 23-25	Las Vegas, Nev.	R. L. Arnett Gen. Chm.	First Western Bank Bldg., Pasadena, Calif.

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SOUTH CAROLINA—Established office in small college town; Piedmont district of South Carolina; three operating rooms with good equipment; wonderful opportunity for someone to take over a good practice with a minimum outlay; for details contact Dr. A. D. Salter, Box 360, Clinton, S. C.

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FLORIDA—Indiantown. Seeks dentist with Florida license to share offices with physician in new community medical building; excellent opportunity; no dentist in this area; growing rapidly with new Pratt & Whitney plant in immediate area; prefer reasonably mature man with sensible outlook; own equipment (preferred); possibly semi-retired. Write to Indiantown Co., 706 Chase Ave., West Palm Beach, Fla.

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TEXAS—Internship. Dental rotating; American Dental Association approved; in 1,300 bed general hospital affiliated with Texas Dental College; $2,130 per annum; well rounded training; opportunity for research. Write to Chief, Dental Service, VA Hospital, Houston, Texas.

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ARIZONA—Association or location by dentist age 31; military requirements completed; six years' private practice; prefer Phoenix or Tucson area; address A.D.A. Box No. 873.

●

Recent graduate wishes to locate in Arizona; desires location or opportunity for association; military service completed; will take Board this summer; references furnished on request. Address A.D.A. Box No. 874.

●

CALIFORNIA — Association desired; 1956 Minnesota graduate age 30 desires association in California; leaving military service June 9. Write to Dr. Gerald Adler, Dental Service, Fort Ord, Calif.

●

CALIFORNIA—1955 U. C. graduate, 28, ambitious, desires general or specialized practice association in the Los Altos to San Jose area. Completing service obligation July 1958; three years' hospital duty including internship. Address A.D.A. Box No. 875.

●

Orthodontist—California licensed, completing University training in June in the edgewise technic, desires full or part time association or location in southern California; age 29; military obligation completed. Address A.D.A. Box No. 876.

●

COLORADO licensed; retired army dentist, age 60; good health, desires association with ethical practitioner or group; operative dentistry and periodontics preferable; location unimportant; Address A.D.A. Box No. 877.

●

FLORIDA licensed general practitioner; well qualified; age 41; married; now practicing in midwest, wants to live in Florida and desires pleasant association with congenial, ethical dentist; coastal area preferred but not essential. Address A.D.A. Box No. 878.

●

ILLINOIS-MISSOURI — Completing military service in July. Desire location in town of 3,000 to 10,000 population and within 75 miles of Chicago, St. Louis or Kansas City. Address A.D.A. Box No. 879.

●

ILLINOIS licensed dentist, 28; desires association or opportunity such as leasing medical center space in Chicago suburb; will complete military obligation by August 1958. Address V. J. Corrado, 406 Babb, Midwest City, Okla.

●

General practitioner, Northwestern '52, who has been practicing abroad, desires association; Chicago or northeastern Illinois. Address A.D.A. Box No. 880.

●

NEW YORK licensed dentist seeks an association that will terminate in the eventual purchase of an active, general practice. May also consider the outright purchase of a practice. Address A.D.A. Box No. 881.

●

NEW YORK licensed dentist completing military obligations this April; desires association or other opportunity with dentist in New York City or vicinity; well grounded in all phases. Address A.D.A. Box No. 882.

●

General practitioner, completing military obligations in April, desires interesting overseas or industrial position; proficient in all phases of dentistry; New York and national Boards. Address A.D.A. Box No. 883.

●

NEW YORK-NEW JERSEY licensed dentist desires general practice association with opportunity for eventual partnership or purchase; married; family; completing military service; 100 mile radius New York City. Address A.D.A. Box No. 884.

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●

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NEW YORK—1955 graduate, married, age 27, completing military service September 1958, desires employment or association in central state, Long Island or Westchester; have own equipment if needed. Address A.D.A. Box No. 889.

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OHIO licensed dentist, married, will complete military obligation in July 1958; will consider new location, established practice or association preferably in small city or suburban area. Address A.D.A. Box No. 890.

●

OREGON — Experienced, licensed general practitioner, age 37, with family, desires association with busy ethical dentist in Oregon; background and references available on request. Address A.D.A. Box No. 891.

●

VIRGINIA licensed dentist, married, veteran, age 31, desires association with established dentist or hospital; two and one-half years' general practice. Address A.D.A. Box No. 892.

●

VIRGINIA licensed dentist, completing military service in March, desires association in established general practice; experienced in all phases of general dentistry. Address A.D.A. Box No. 893.

●

1953 graduate, married, military obligations completed, desires association in Massachusetts or New Hampshire with general practitioner of an ethical active practice who contemplates retiring and eventually turning over his practice to associate; conscientious, progressive and well trained in all phases of dentistry. Address A.D.A. Box No. 894.

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Oral surgeon desires association with established oral surgeon or location where needed; married, children, military obligation completed, one year graduate school, two years hospital training in oral surgery, thorough experience administration general anesthesia. Address A.D.A. Box No. 897.

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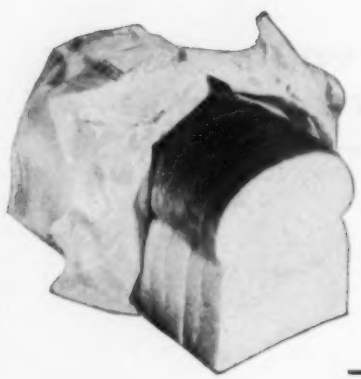

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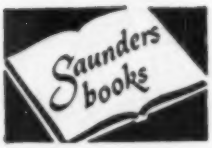

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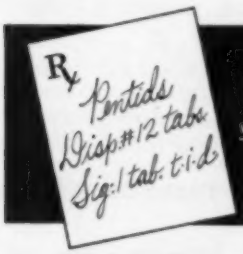

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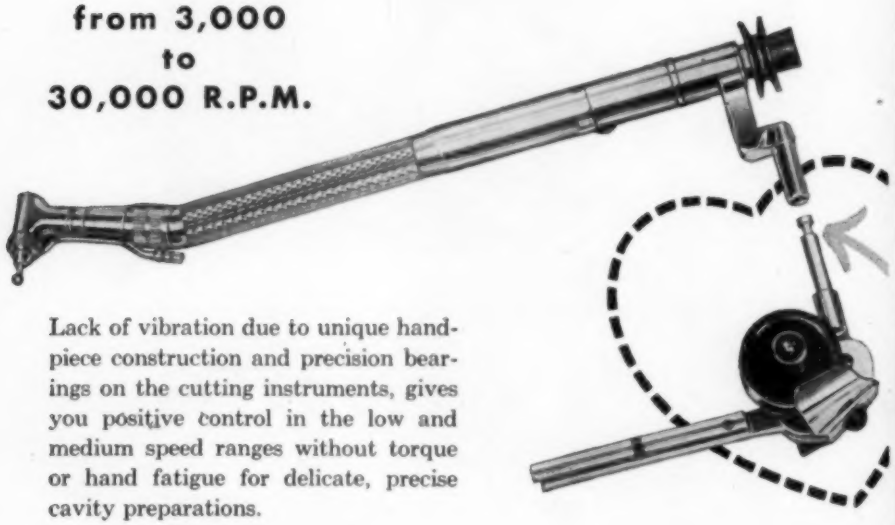

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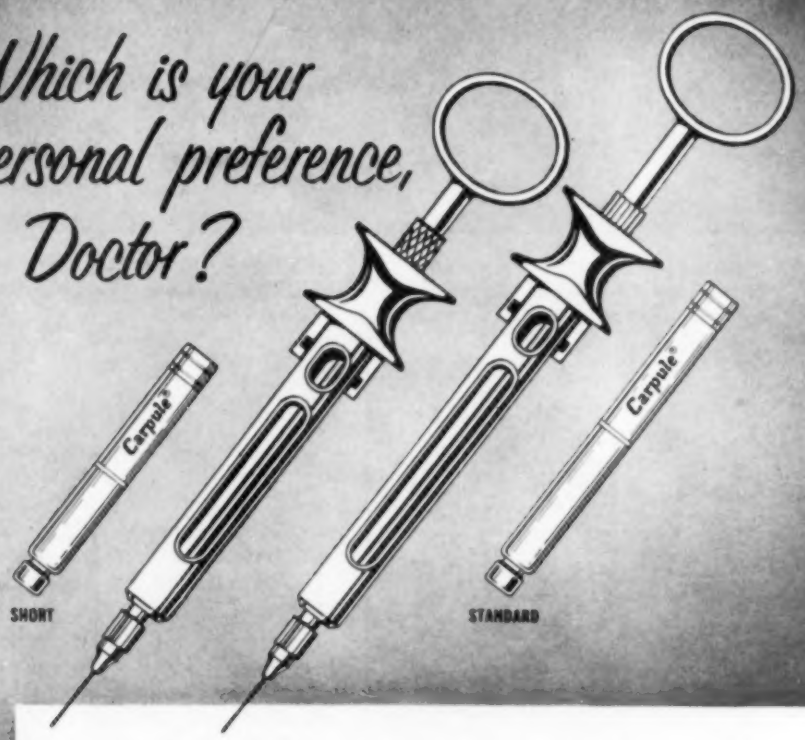

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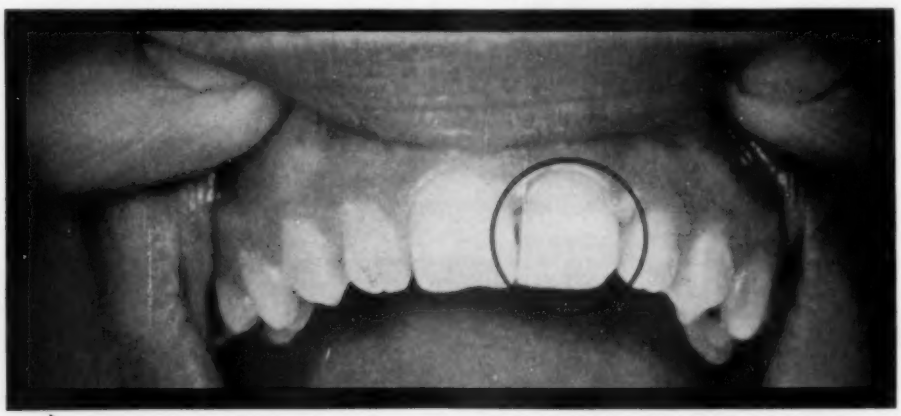

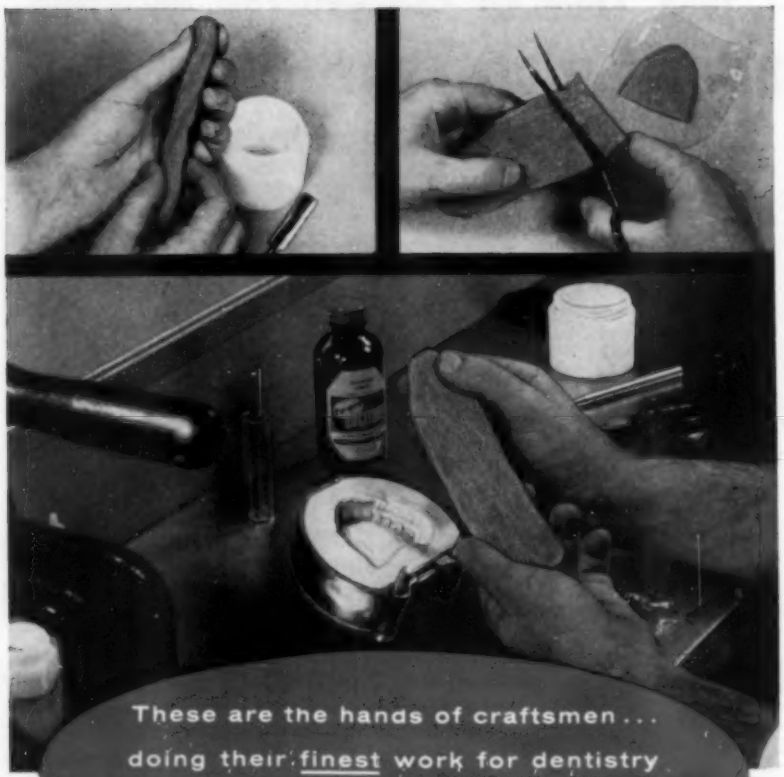

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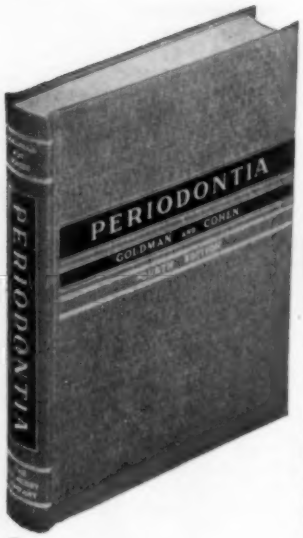

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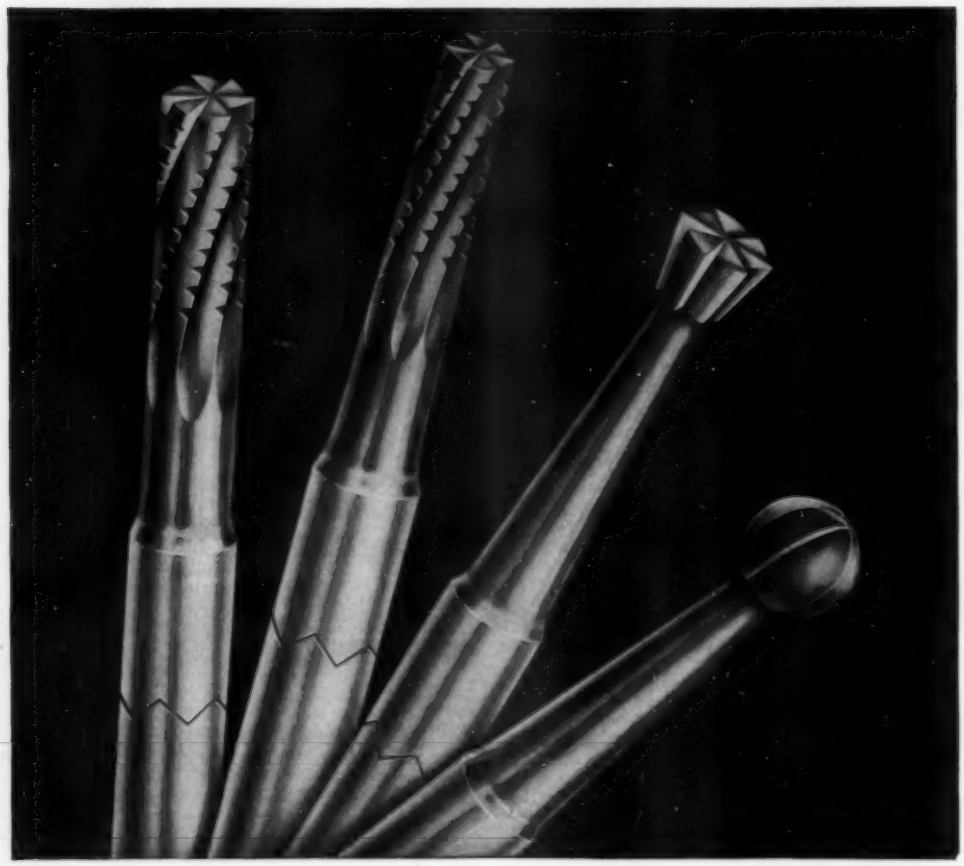


NO. 14

DU PONT

DENTAL X-RAY NEWS

Better Things for Better Living . . . *through Chemistry*

Du Pont films permit

shortest exposures with all x-ray units

Whatever x-ray unit you use, whether you prefer 8" focal-film distance or long cone technique, there's a Du Pont film that will give you the best results with minimum exposure time.

For instance, the radiograph on the left, above, was made on Du Pont *Lightning Fast* Dental X-ray Film at 65 kv.p., 10 ma. Long cone technique – 20" distance.

The radiograph at the right was made on Du Pont D-1 Dental X-ray Film, also at 65 kv.p., 10 ma. Focal-film distance–8".

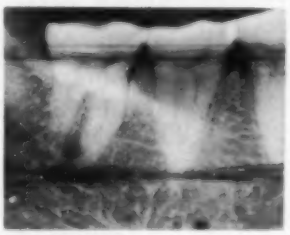
Both films were exposed for only *1½ seconds*. Yet the resulting radiographs are almost identical, with the same high diagnostic quality.

Du Pont *Lightning Fast* Film is an extremely fast film designed for split-second exposures. It is also ideal to use with low-powered units with fractional-focus tubes. Because of its speed, the accuracy of the timer is very important.

Du Pont *D-1* is a fast, all-purpose film designed for use with standard 65 kv.p., 10 ma. units with exposures timed mechanically. It combines wide latitude with speed–an ideal dental x-ray film.

The next time you order, specify Du Pont. You'll find there's a Du Pont Dental X-ray Film that's just right for your technique.

HOW TO AVOID POOR RADIOGRAPHS



Proper handling of x-ray film before exposure and processing can save you a lot of time. The radiograph above was bent to fit the patient's mouth as it was put in position. As often happens when film is bent, it kinked—producing the black marks which appear on the film.

These kink marks often mean a retake so that a proper diagnosis can be made. To prevent kink marks, be careful not to bend the film packet when placing it in the mouth.

A new Du Pont film strip, "Darkroom Pathology," which shows how to recognize and avoid film artifacts, is available. Write Du Pont Photo Products Department, 2420-2 Nemours Building, Wilmington 98, Delaware, and arrangements will be made to show it to your group.

DU PONT

Better Things for Better Living
. . . *through Chemistry*

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What is a Sensible Breakfast During the Growth Years?

Children who eat nutritious breakfasts regularly are more likely to be well nourished than those with poor breakfast habits.* This important finding emphasizes the long-known relationship between nutritious breakfast meals and the performance level of school children.

A sensible breakfast for most children is one which supplies ample energy for a full morning's work and play; which provides ample growth-promoting protein, vitamins, and essential minerals; which is tasteful, easy to digest, and is eaten in a pleasant atmosphere; but which does not burden the digestive tract unduly or overload the food capacity of the child.

A dish of oatmeal provides nutritional advantages few foods can exceed. It contains more protein and more thiamine than other whole grain cereals. In addition, it contributes other B vitamins and is outstanding for its iron content.

A steaming bowl of oatmeal is a dish welcomed by children. It reflects a warm, secure home atmosphere. It means a pleasant, satisfying meal with which to start the day's work and play.

Quaker Oats and Mother's Oats, the two brands of oatmeal offered by The Quaker Oats Company, are identical. Both brands are available in the Quick (cooks in one minute) and the Old-Fashioned varieties which are of equal nutrient value.

*Martin, E. A.: Roberts' Nutrition Work with Children, Chicago, The University of Chicago Press, 1954, pp. 141-146.

DENTAL AUTHORITIES stress the importance of optimal nutrition in the aim toward better dental health during the early growth years. Oatmeal, with its wealth of essential nutrients, not only contributes broadly to good nutrition, but—since its carbohydrate is not readily degraded to simple fermentable sugars—is of virtually no cariogenic influence.

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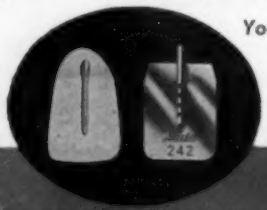

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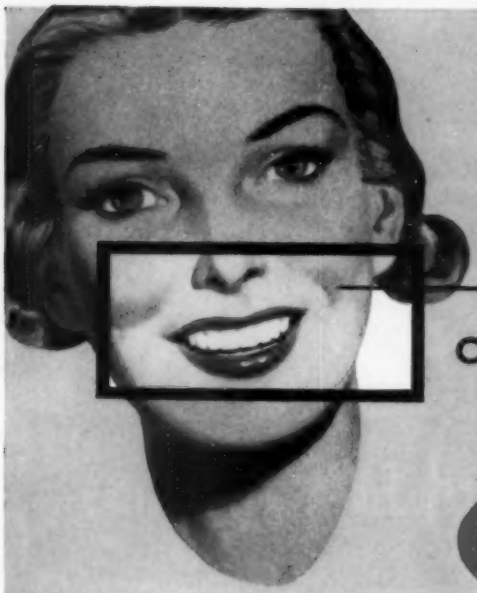

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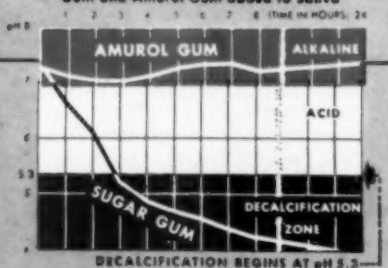

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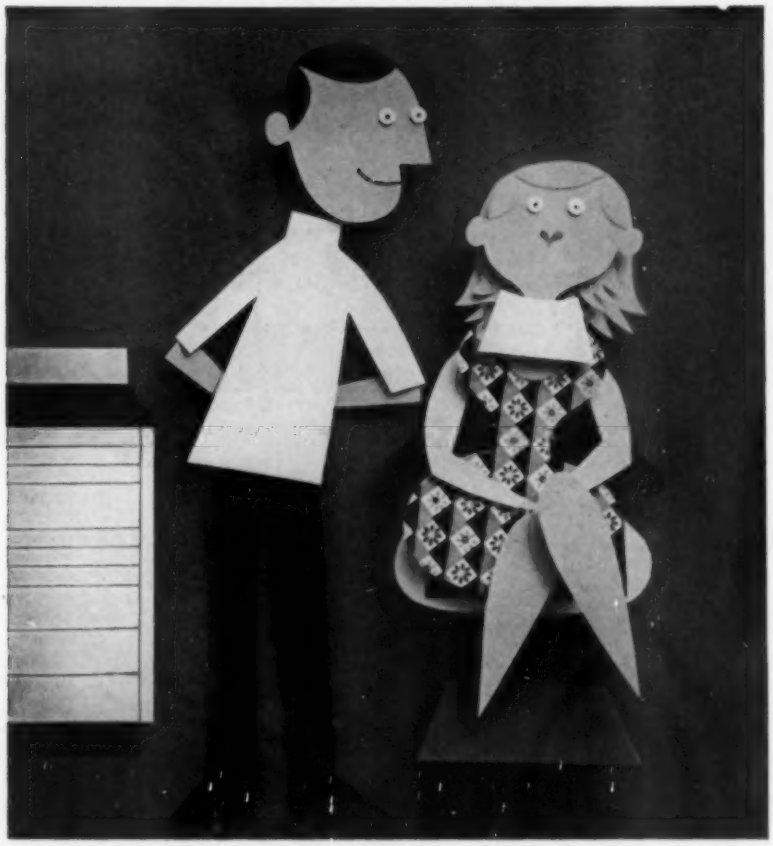

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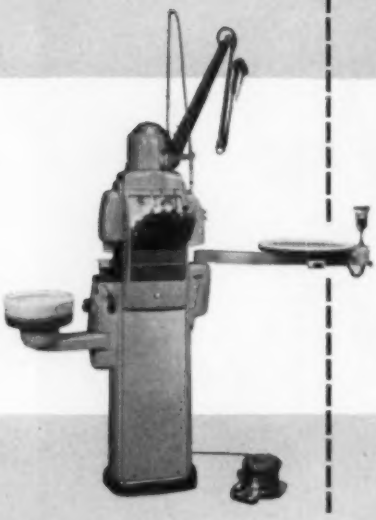

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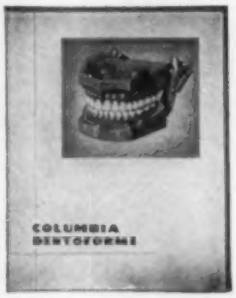

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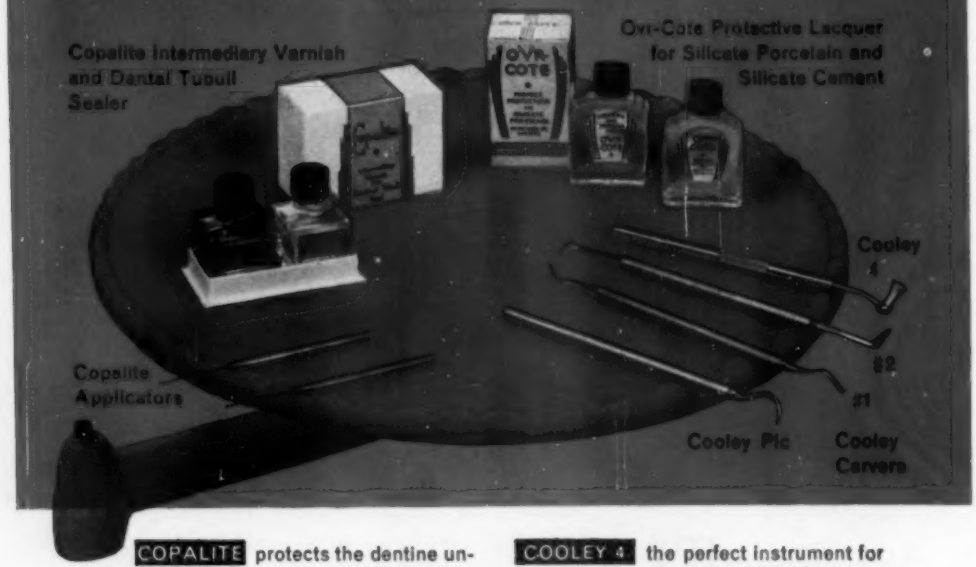

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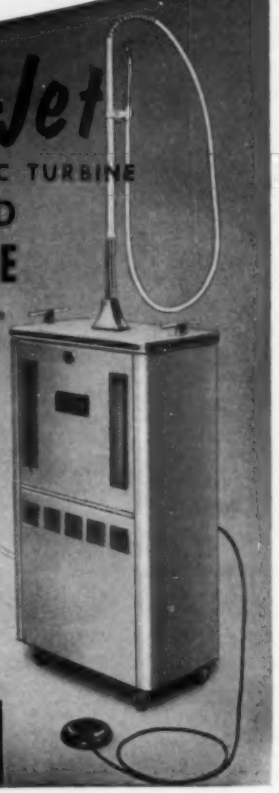

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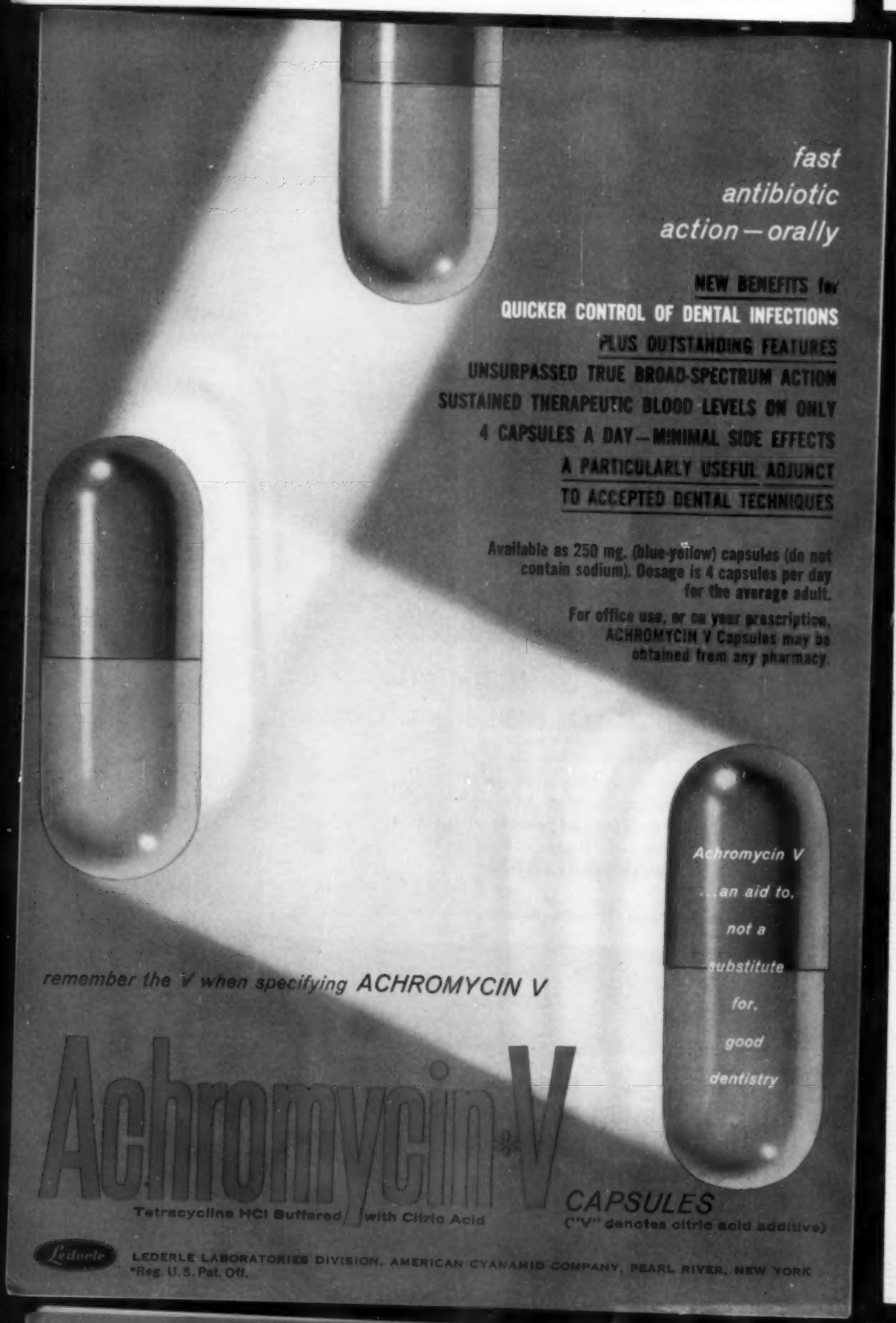
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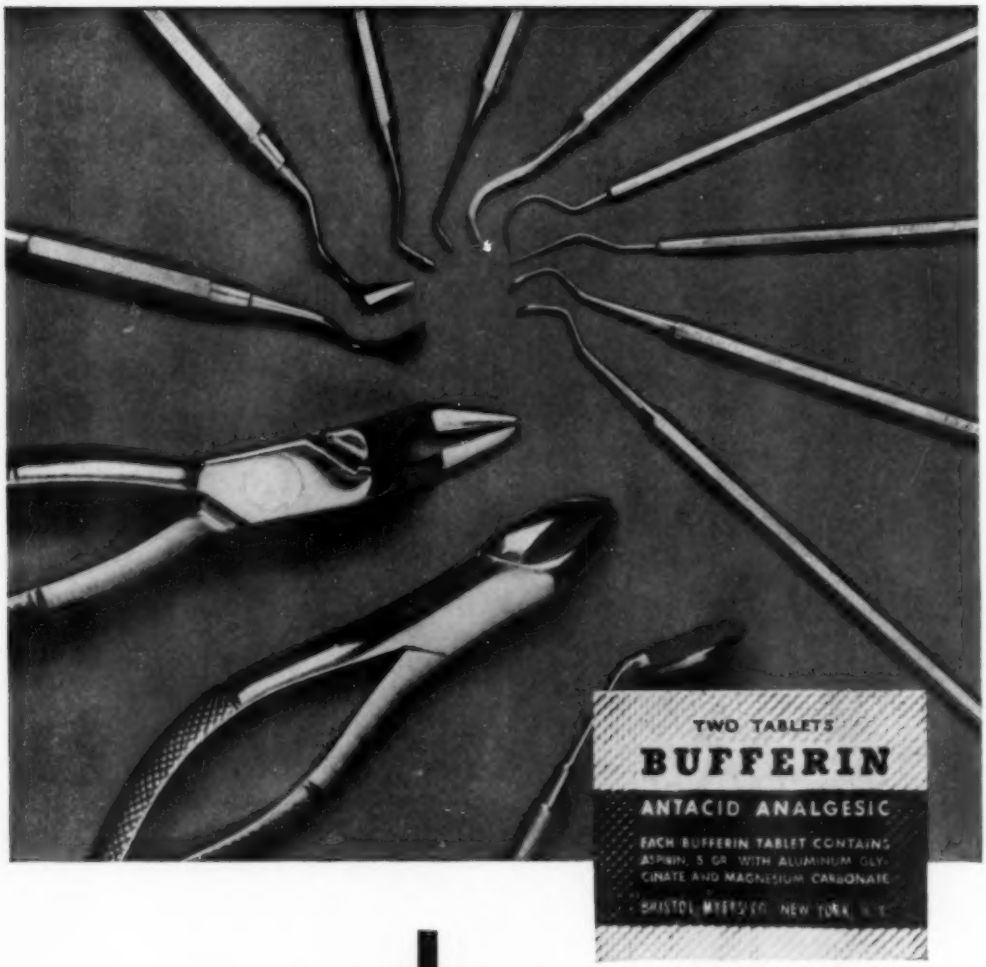
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